Rack-Mount Workstation/Server

System Reference

November 1997

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INTERGRAPH
COMPUTER SYSTEMS

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This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Warnings

To reduce the risk of electrical shock, do not attempt to open the equipment unless instructed. Do not use a tool for purposes other than instructed.

There is a danger of explosion if the battery is incorrectly replaced. Replace the battery only with the same or equivalent type as recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Notes

Read all operating instructions before using this device. Keep these instructions for future reference. Follow all warnings on the device or in the operating instructions.

Contents

Introduction

This *System Reference* provides the information necessary to service the following systems:

- TDZ-425 RAX and TDZ-612 RAX workstations
- StudioZ RenderRAX
- InterServe 615R and 625R servers

Document Conventions

Bold	Commands, words, or characters that you key in literally.
Italic	Variable values that you supply, or cross-references.
`Monospace`	Output displayed on the screen.
SMALL CAPS	Key names on the keyboard, such as D, ALT or F3. Names of files and directories. You can type filenames and directory names in the dialog boxes or the command line in lowercase unless directed otherwise.
CTRL+D	Press a key while simultaneously pressing another key; for example, press CTRL and D simultaneously.

Additional System Information

A *System Setup* is shipped with each system, and provides detailed information about:

- Configuring the operating system and associated system software
- Using the system
- Using the AMIBIOS Setup program
- Installing system software

A *System Introduction* is delivered with the system, and provides information about:

- Intergraph Support
- System hardware features
- Available hardware option

1 Accessing the System

This chapter lists hand tools and describes servicing restrictions, opening the base unit, avoiding electrostatic discharge, removing and attaching the face plate, and closing the base unit.

This system features a telescoping chassis that provides increased serviceability and access to internal components. The telescoping section, to which the system board is mounted, is secured by five screws and slides out from the rear.

NOTE "Right side" and "left side" are as seen from the front of the base unit.

CAUTION Follow all warnings and cautions in servicing instructions. Personal injury and damage to equipment can occur if documented procedures are not followed.

CAUTION Use an antistatic wrist strap for all servicing procedures to avoid the possibility of electrostatic discharge.

Tools

You will need the following tools to service the system:

- Antistatic wrist strap
- Quarter-inch nutdriver
- No. 1 and No. 2 Phillips screwdrivers
- Three-sixteenth-inch nutdriver
- Five-sixteenth-inch or 8 mm nutdriver
- Small single-slot screwdriver

Opening the Base Unit

CAUTION Shut the system down and turn the system power off. Use caution to avoid injury when removing covers and other hardware.

CAUTION If the system is installed in a free-standing rack, ensure front and side stabilizers are fully extended.

To open the base unit:

1. Remove the screws that secure the face plate to the rack.
2. Slide the system out of the rack until it locks in the extended position.
3. Remove the following eight screws that secure the cover to the chassis: One at right and left top corners of face plate; two at top, back of cover; and two at right and left sides, back of cover.
4. Slide the cover back about an inch, then lift the cover off.
5. Attach grounding clip from antistatic wrist strap to bare metal.

Protecting Against Electrostatic Discharge

Sensitive components inside the base unit can be damaged by static electricity. To protect against this possibility, take the following precautions when working with the system's internal components.

- Touch the bare metal of the base unit to ensure it and your body are at the same electric potential.
- Handle all printed circuit boards as little as possible and by the edges only. Leave new parts in their protective packaging until you install them.
- Use a disposable or reusable antistatic wrist strap when servicing or upgrading the system. Once a disposable wrist strap is used, it cannot be used again. A reusable antistatic wrist strap can be attached to any bare metal part of the base unit. The metal conductor bead in the elastic sleeve of reusable antistatic straps must contact bare skin.

Removing the Face Plate

To remove the face plate:

1. Remove the cover.
2. Remove one lower screw on each side of system front that secures handle to the base unit.
3. Remove the six screws that secure face plate to the base unit.
4. Pull the face plate toward you to remove it. Note how the bottom lip of the face plate attaches to the cutout in front of the power supply.

Attaching the Face Plate

To attach the face plate:

1. Push the face plate onto the base unit. Ensure that the top part of the lip at bottom slides over the cutout in front of the power supply.
2. Adjust the face plate as needed to ensure all components are flush.
3. Secure the face plate to the base unit.
4. Close the cover.

Closing the Base Unit

CAUTION After servicing the system, always replace the covers that were removed. The covers ensure the system maintains proper air flow, so internal components do not overheat and fail. The covers also ensure that electromagnetic interference (EMI) emissions remain below the standard requirements.

To close the base unit:

1. Remove the antistatic wrist strap from the base unit.
2. Replace the cover.
3. Slide the base unit into the rack.
4. Secure the base unit with screws at each corner of the face plate.

2 Servicing the System

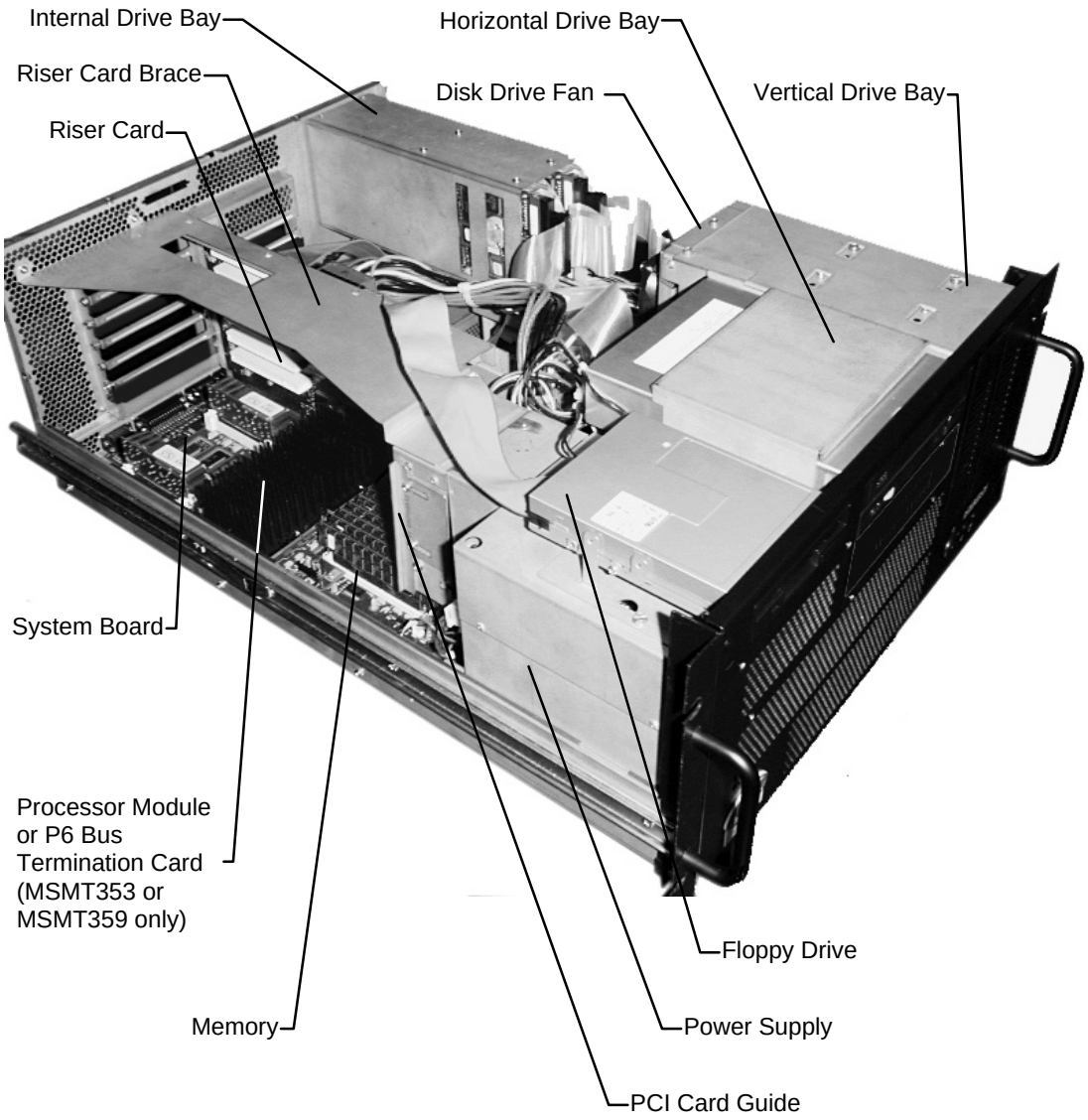
This chapter describes how to replace the standard parts within the system.

NOTE Refer to Chapter 1 for details on opening the system and protecting against electrostatic discharge.

CAUTION Follow all warnings and cautions in servicing instructions. Personal injury and damage to equipment can occur if documented procedures are not followed.

CAUTION Use an antistatic wrist strap for all servicing procedures to avoid the possibility of electrostatic discharge.

The following shows the location of major parts in the system. Unit with MSMT353 system board is shown.

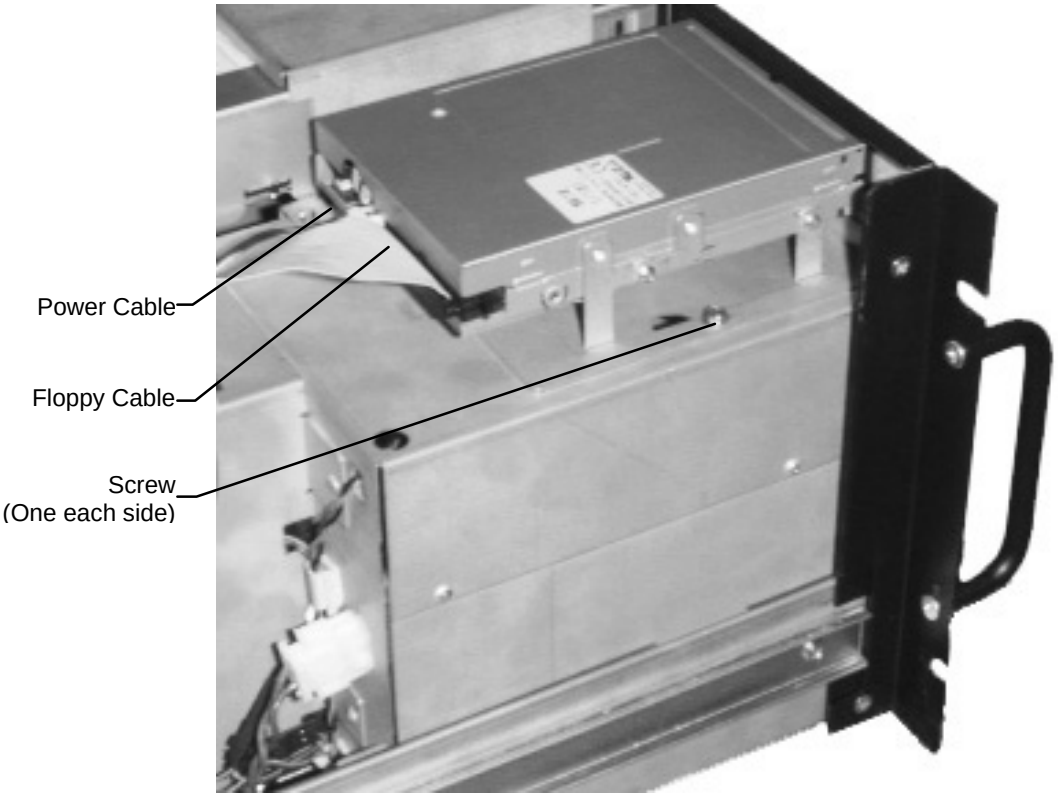


Peripheral Drives

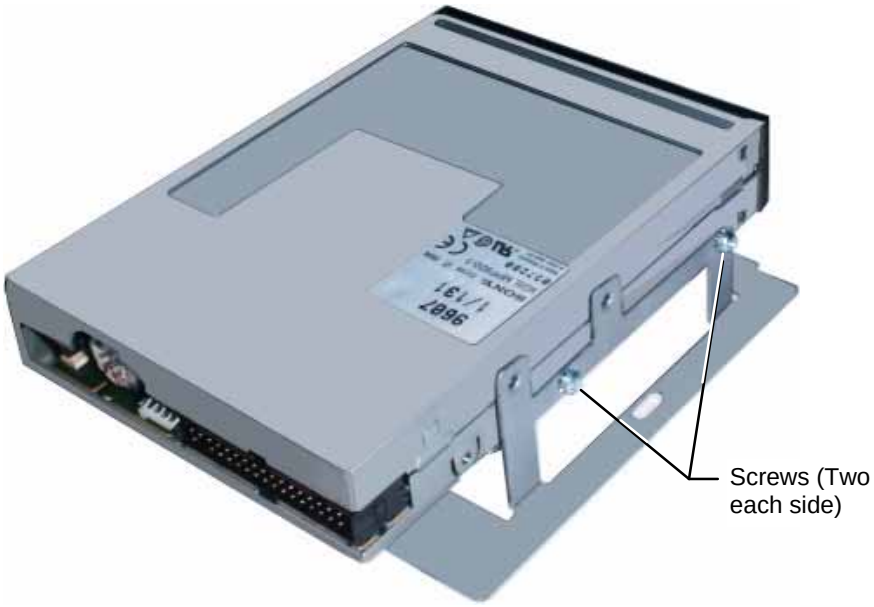
Floppy Disk Drive

To replace the floppy disk drive:

1. Disconnect the power cable and floppy cable from the drive as shown in the following figure. Note the position of the red stripe on the floppy cable.
2. Remove the two screws securing the drive bracket to the power supply.



3. Remove the four screws securing the bracket to the drive as shown in the following figure.



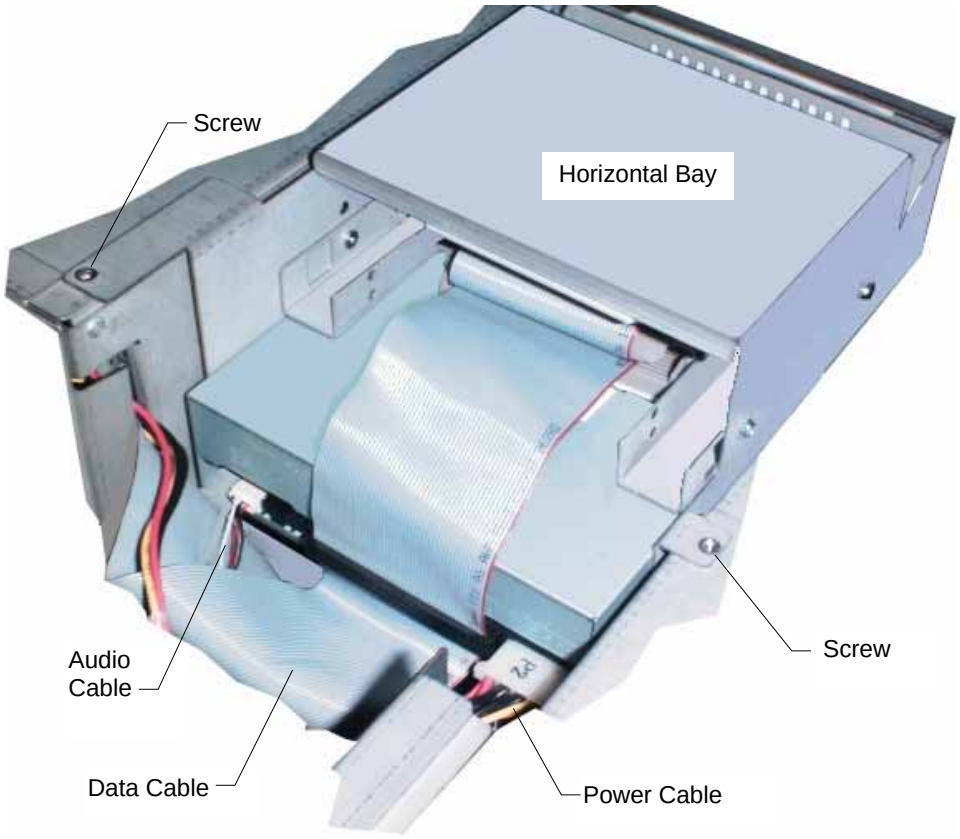
4. Attach the new drive to the bracket and attach it to the power supply. Connect the power cable and floppy cable. Ensure the red stripe on the floppy cable is oriented correctly.
5. Close the base unit.

CD-ROM Drive

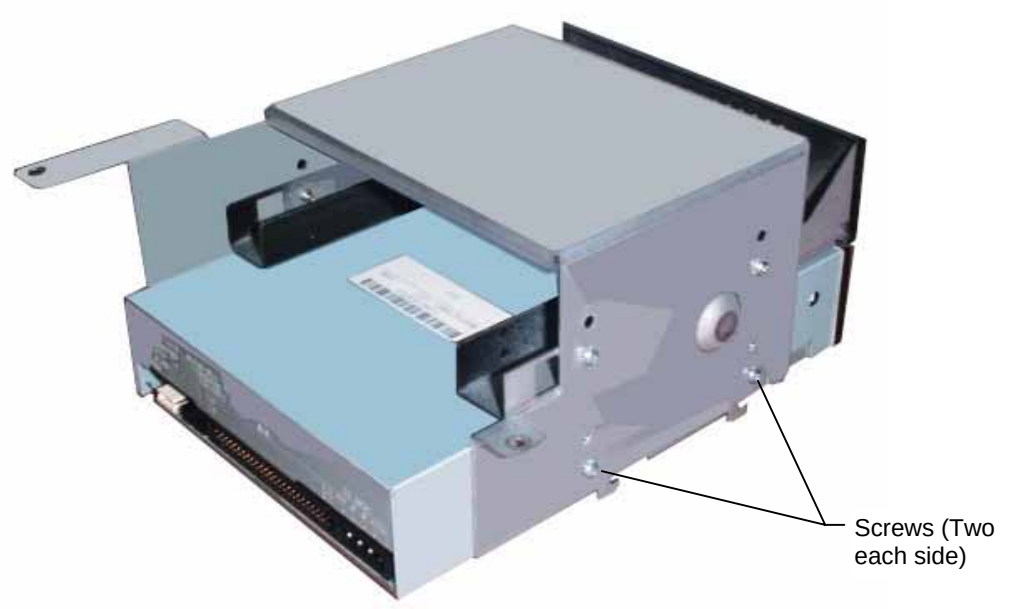
Depending on system options, the CD-ROM drive may be a SCSI drive or an EIDE drive. Refer to Chapter 9, “Peripherals,” for details.

To replace the CD-ROM drive:

1. Disconnect the power cable, data cable, and audio cable from the CD-ROM drive as shown in the following figure. Note the position of the stripe on the data cable.
2. Remove the screws securing the horizontal bay to the base unit.



3. Remove the four screws securing the drive to the drive bay as shown in the following figure.



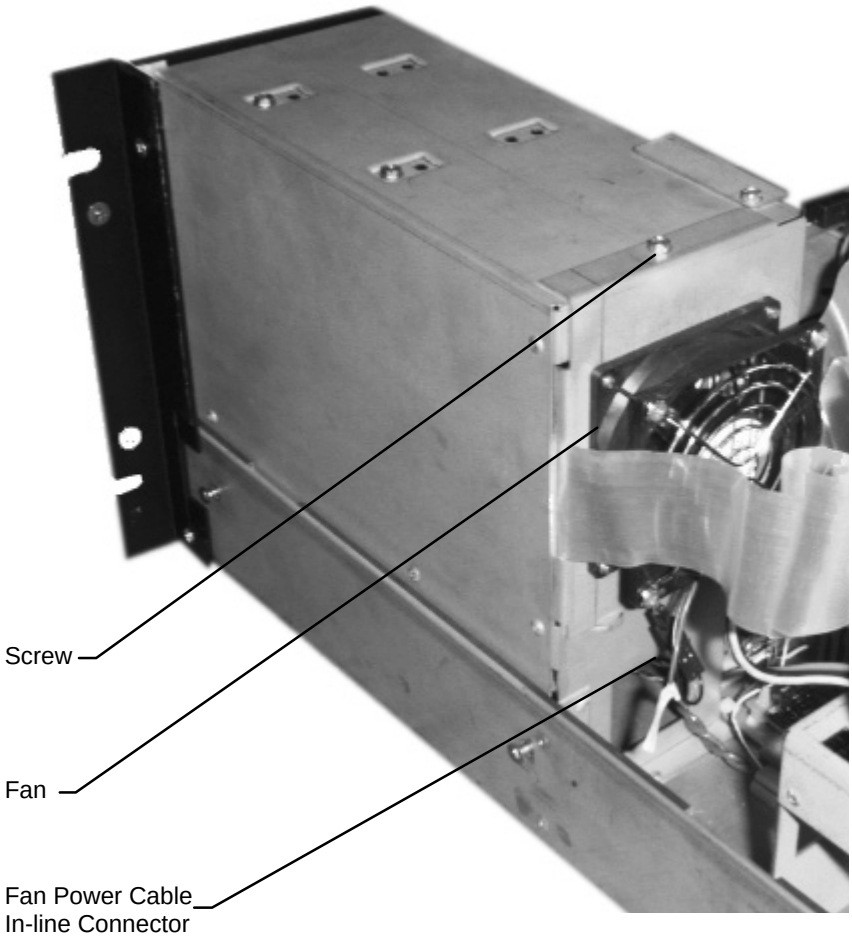
4. Set the SCSI ID on a new SCSI drive to the same ID as the old drive. On a new EIDE drive, set the mode select header to “master.” Refer to Chapter 9, “Peripherals,” for details.
5. Attach the new drive to the horizontal bay and attach it to the base unit. Connect the power cable, data cable, and audio cable. Ensure the stripe on the data cable is oriented correctly.
6. Close the base unit.

Vertical Bay Disk Drives

If Kingston removable disk modules are installed in the system, refer to the Kingston documentation for disk drive or module replacement instructions.

To replace drives in the vertical bay:

1. Remove the disk drive fan by removing the screw at the top of the vertical bay and disconnecting the fan power cable from the inline connector.



2. Disconnect the power cable and SCSI cable from the disk drive.

3. Remove the screws securing the disk drive at the top of the vertical bay as shown in the following figure.

4. Pull out the black disk drive tray through the front of the system. The disk drive is attached to the tray.

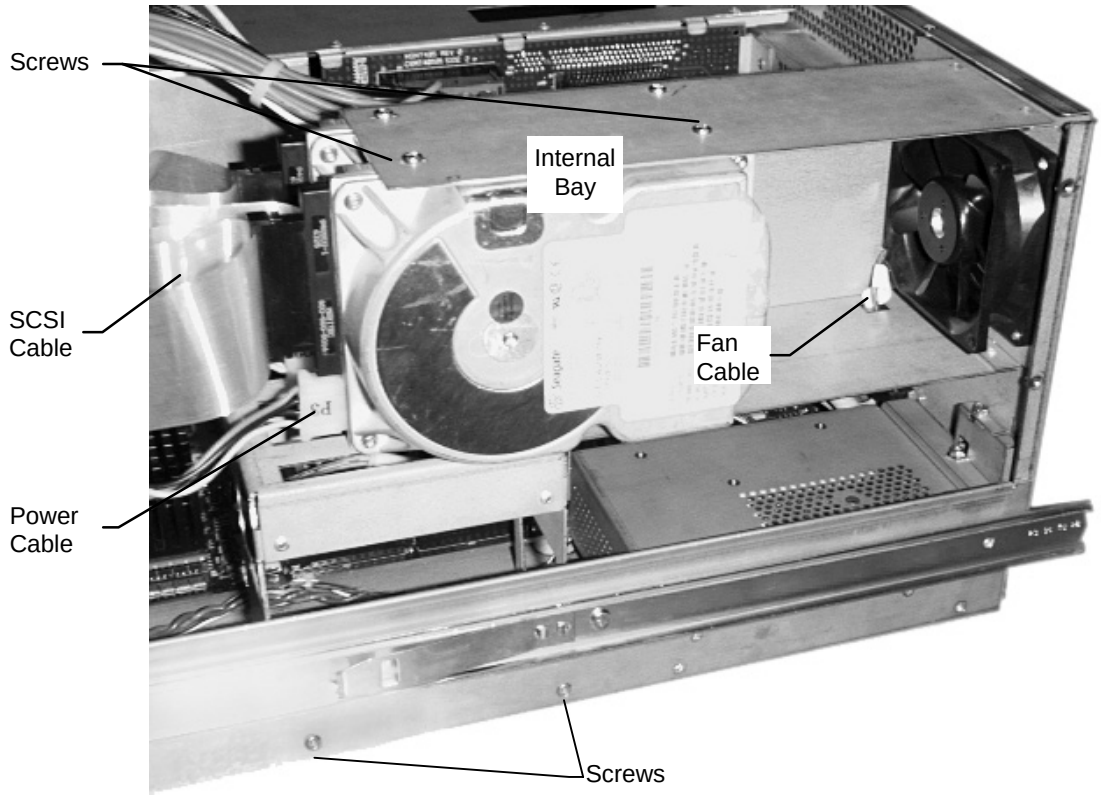
5. Remove the slot filler by removing screws as shown in the following figure; then remove the four screws securing the disk drive to the tray.

6. Set the SCSI ID on the new disk drive to the same SCSI ID as on the old disk drive.
7. Attach the new disk drive to the tray and slide it into the vertical bay.
8. Secure the drive to the bay.
9. Connect the SCSI cable and power cable to the disk drive.
10. Replace the disk drive fan and connect the fan power cable.
11. Close the base unit.

Internal Bay Disk Drives

To replace drives in the internal bay:

1. Disconnect the SCSI cable and power cable from the disk drive as shown in the following figure.
2. Disconnect the fan cable. Note the location where the fan cable connects to the system board.
3. Remove the two screws that secure the internal bay to the base unit.
4. Slide the internal bay toward the front until it disengages; then lift it out of the system.

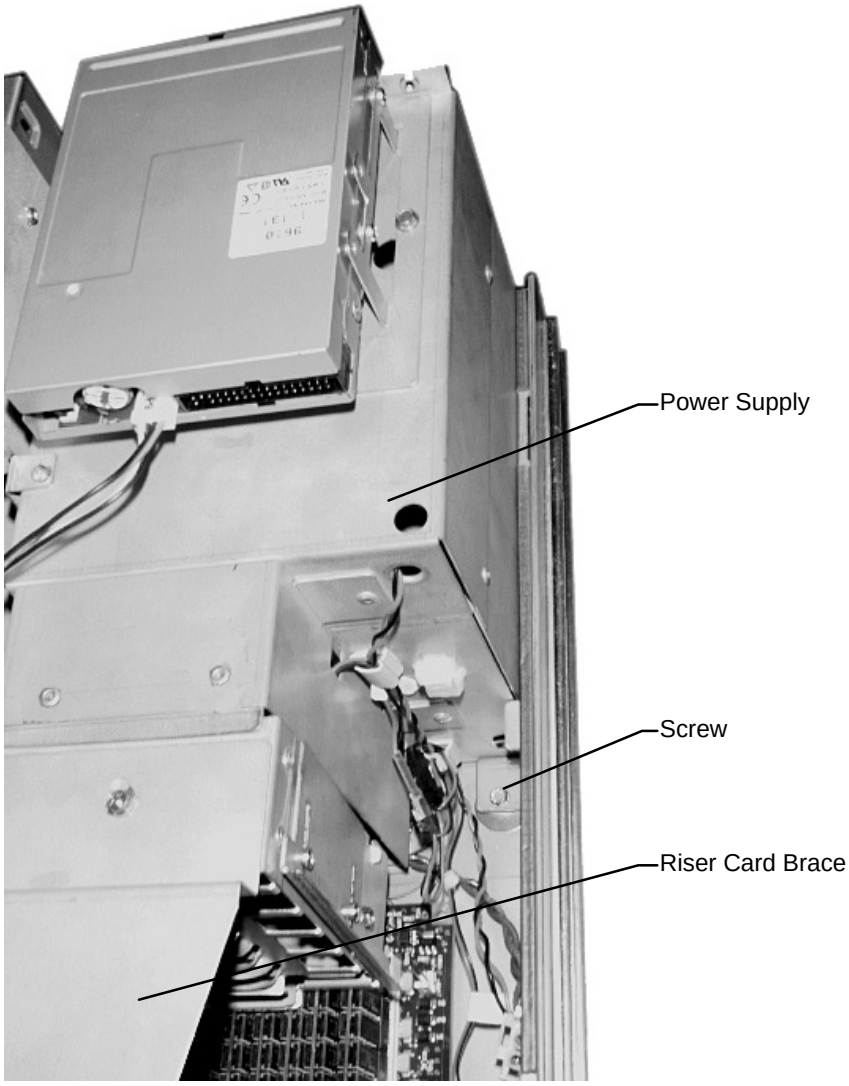


5. Remove the screws that secure the disk drive to the internal bay. Two screws are on top, as shown, and two are on the bottom.
6. Remove the disk drive from the bay.
7. Set the SCSI ID on the new disk drive to the same SCSI ID as on the old disk drive.
8. Attach the new disk drive to the internal bay.
9. Place the internal bay into the base unit, and slide it toward the rear until it engages.
10. Attach the bay to the base unit.
11. Connect the SCSI cable and power cable to the disk drive.
12. Connect the fan cable to the system board.
13. Close the base unit.

Power Supply

To replace the power supply:

1. Open the unit and remove the face plate as described in Chapter 1.
2. Disconnect all power cables from the internal devices (riser card, floppy disk drive, internal disk drive bay, vertical and horizontal disk drive bays, and speaker).



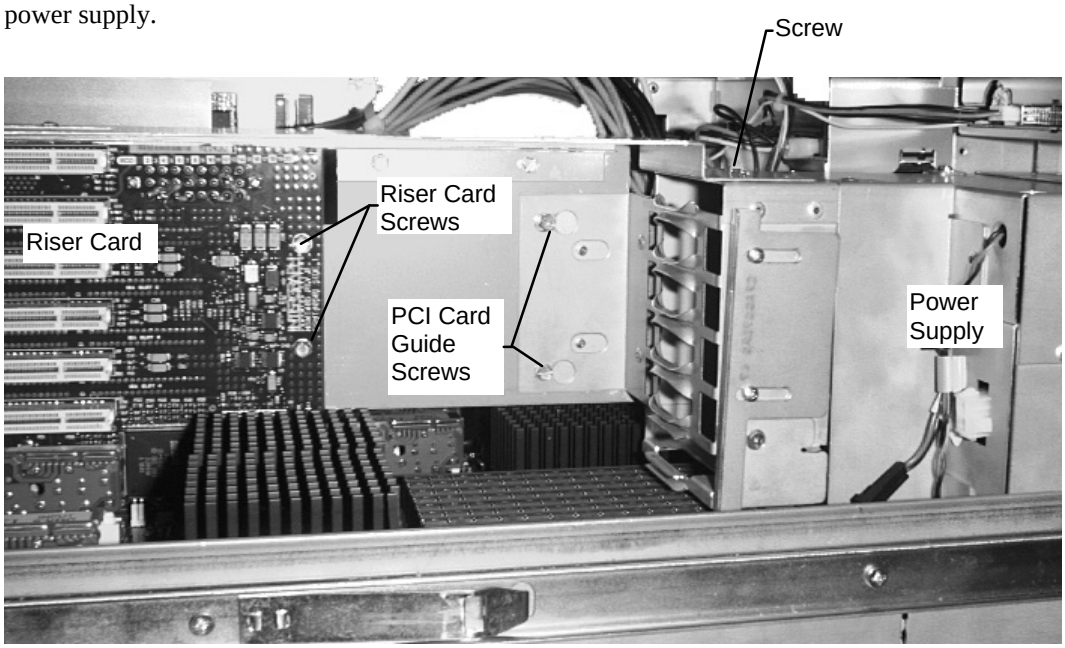
3. Disconnect the AC power cable from the rear of the power supply. (The AC power cable is routed from the line filter).
4. Remove the floppy drive and the horizontal drive bay. Refer to the respective procedures earlier in this chapter.
5. Disconnect the speaker cable and remove the speaker. (Any system with the MSMT378 system board does not have a speaker). Refer to the “Speaker” procedure later in this chapter.
6. Remove the screw securing the power supply to the base unit.
7. Pull the power supply forward until it disengages; lift up to remove it.

8. Place the new power supply into the base unit, and push it forward until it engages.
9. Secure the power supply to the base unit.
10. Connect the power cables to the internal devices.
11. Connect the AC power cable to the power supply.
12. Attach the floppy drive and horizontal drive bay.
13. Install the speaker and connect the speaker cable.
14. Install the face plate and cover.

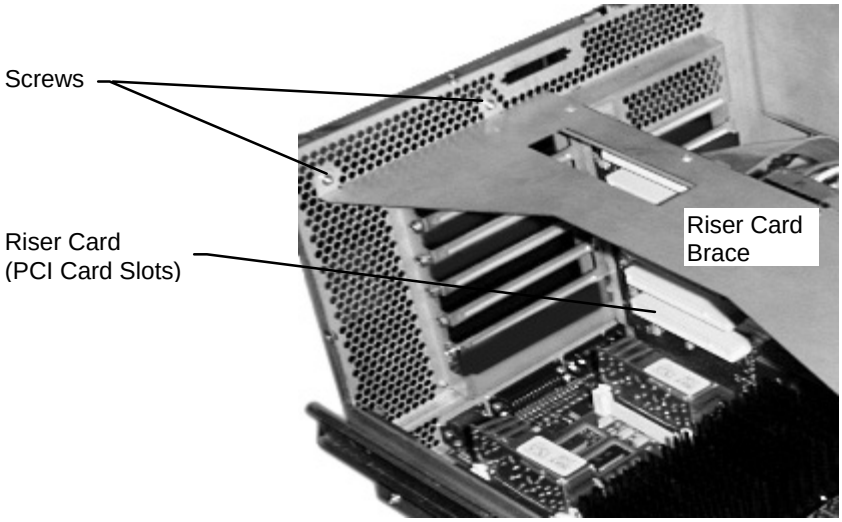
Riser Card

To replace the riser card:

1. Open the base unit as described in Chapter 1.
2. Remove all installed option boards. If ISA boards are installed, remove the internal disk drive bay, and then remove the ISA cards. Refer to "Internal Bay Disk Drives" earlier in this chapter.
3. Disconnect the SCSI cable and power cable from the riser card.
4. Remove the screw that secures the riser card brace to the top of the PCI card guide.
5. Loosen the two screws that secure the riser card brace to the PCI card guide, slide the card guide back, and remove the card guide. Note how the PCI card guide fits over the lip on the rear of the power supply.



6. Remove the two screws securing the riser card brace to the back of the system.



7. Remove the two screws that secure the riser card to the brace.
8. Remove the riser card brace.
9. Grasp the riser card firmly on both ends, and carefully pull straight up until the card disengages.
10. Insert the new riser card into the system board connector. Press firmly over the center of the PCI connectors to fully seat the card.

CAUTION Do not rock the riser card back and forth; pins inside the connector may be damaged as a result. Press firmly so the card connector slides evenly into the slot.

11. Install the riser card brace, and install the two screws securing the card to the brace.
12. Place the PCI card guide on the two screws attached to the riser card. Slide the guide over the lip on the rear of the power supply, then tighten the screws.
13. Attach the top of the riser card brace to the PCI card guide.
14. Replace the two screws securing the rear of the riser card brace to the back of the system.
15. Connect the power and SCSI cable to the riser card.
16. Replace any PCI or ISA option boards, and the internal drive bay (if removed).
17. Close the base unit.

P6 Bus Termination Card

The P6 bus termination card, MSMT311, is used only in systems with the MSMT353 or MSMT359 system board that has one or two processors. Refer to Chapter 5, “System Board MSMT353 and MSMT359,” for details.

To replace the P6 Bus termination card:

1. Open the base unit.
2. Remove the installed PCI cards. The termination card is attached to the system board adjacent to the memory modules.
3. Remove the screws securing the termination card to the system board.
4. Carefully disengage the card from the system board and remove it.
5. Attach the new card to the system board, and secure the card with the screws.
6. Replace the PCI cards.
7. Close the base unit.

Processor Module for MSMT353 and MSMT359

The replacement processor module, MSMT364 or MSMT310, for the MSMT353 and MSMT359 system board, includes pre-installed voltage regulator modules(VRMs) and processors.

To replace the processor module:

1. Open the base unit.
2. Remove the installed PCI cards. The processor module is attached to the system board adjacent to the memory modules.
3. Remove the left VRM to access mounting screw.
4. Remove the screws securing the processor module to the system board.
5. Carefully disengage the module from the system board and remove it.
6. Attach the new processor module to the system board, and secure it with the screws.
7. Reinstall the left VRM.
8. Replace the PCI cards.
9. Close the base unit.

Processor Module for MSMT378

The Pentium Pro and Pentium II processors for the MSMT378 system board are housed in plastic processor modules, which have heat sinks attached to one side. When a Pentium II module is installed into an S1 slot, the heat sinks are supported at the bottom by a black plastic bar, which runs between the two bottom-most rows of heat sink fins. The support bar is connected to a support assembly via four posts.

WARNING **Setting processor voltage incorrectly may destroy the processor! Refer to Chapter 6, "System Board MSMT378," for details.**

To replace the processor module:

1. Remove ISA cards if installed.

NOTE Pentium Pro processor modules do not require heat sink support.

2. Remove the top section of the heat sink support, if necessary. The plastic support bar has a tab on each end. Press both tabs inward, towards each other, while using a pulling motion to pull the bar away from the heat sink fins. The support assembly is permanently connected to the system board, and need not be removed.
3. Remove the processor module. Grasp both tabs on the top corners of the processor module and press them inward, towards each other. Then pull the entire module upward, keeping the tabs pressed inward. Heat sinks are permanently connected to the module, and need not be removed.
4. If necessary, set the frequency for the new processor by adjusting jumpers J47 through J50. Refer to Chapter 6, "System Board MSMT378," for more information.
5. Align the new processor module over the S1 slot and firmly press it down into the slot.
6. If necessary, replace the top section of the heat sink support. Gently push the plastic support bar toward the four posts on the heat sink support assembly, until the bar snaps into place.
7. Reinstall the ISA cards.

System Board

Replacement system boards contain pre-installed voltage regulator modules and processors. However, you must swap the memory modules and P6 bus termination card (on MSMT353 or MSMT359) or processor module from the old system board to the new one.

NOTE Steps 10 and 14 apply only to the the MSMT353 or MSMT359 system board.

The telescoping (modular) chassis makes it easier for you to replace the system board. You must remove the unit from the rack before replacing the system board.

WARNING **Two people must remove the unit from the rack. Failure to do so can result in personal injury and equipment damage. The unit is heavy and difficult to handle.**

To replace the system board:

1. Disconnect all external cables from the unit and remove it from the rack. Use a helper!
2. Open the base unit as described in Chapter 1.
3. Remove the riser card and any installed option cards as described earlier in this chapter.
4. Remove the five screws securing the telescoping section to the base unit. There are two screws on the right and three on the left.
5. Pull the telescoping section toward you a few inches.
6. Disconnect all internal cables attached to the system board. Note the locations where the cables are connected.
7. Remove the telescoping section from the base unit.
8. Remove the jackscrews from the parallel and serial ports, and from the three audio jacks.

9. Remove the memory modules from the system board, and place them on an antistatic surface.
10. Remove the processor module (for quad processor systems) or the P6 bus termination card (for dual processor systems) from the MSMT353 or MSMT359 system board as described earlier in this chapter.
11. Remove the eight screws securing the system board to the telescoping section.
12. Lift the system board out of the unit.
13. Install the new system board and secure it with the eight screws.
14. Attach the processor module or P6 bus termination card to the MSMT353 system board.
15. Install the memory modules on the system board.
16. Connect the internal cables to the system board. If you need help identifying cable connections, refer to Chapter 5 for the MSMT353 or MSMT359 system board or Chapter 6 for the MSMT378 system board.
17. Secure the parallel and serial ports and audio jacks with the jackscrews.
18. Slide the telescoping section into the base unit. Ensure that all tabs engage correctly.
19. Install the five screws that secure the telescoping section to the base unit.
20. Install the riser card and option cards, and connect the internal SCSI cable to the riser card.
21. Reinstall the unit in the rack. Use a helper!
22. Close the base unit and reconnect the external cables.

Fans

Refer to Chapter 10, “Power Supply and Fans,” for details on fans.

NOTE Airflow in the system is front to back. Arrows on the fan indicate airflow direction and rotation. Ensure that you install fans with arrows pointing to the back of the system.

Power Supply Fan

To replace the power supply fan:

1. Open the base unit.
2. Remove the power supply as described earlier in this chapter.
3. Disconnect the fan power cable.
4. Note the airflow direction of the fan, and then remove the four screws securing the fan to the power supply housing.
5. Install the new fan on the power supply housing.
6. Reinstall the power supply and connect the fan power cable.
7. Close the base unit.

System Fans

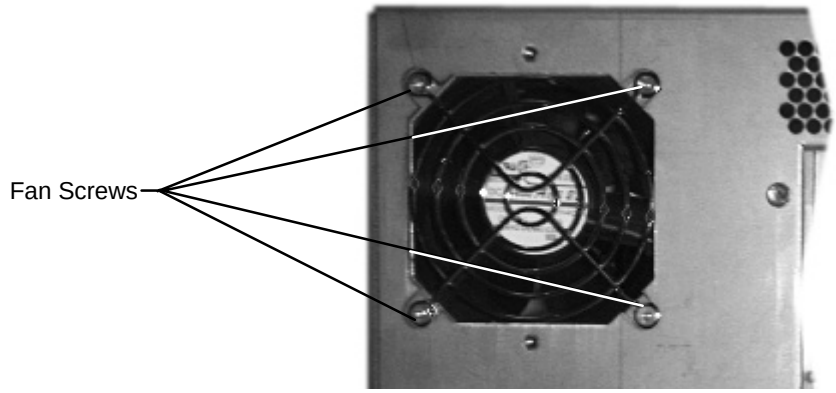
To replace a system fan:

1. Open the base unit.
2. Remove the power supply as described earlier in this chapter.
3. Disconnect the fan power cables.
4. Note the airflow direction of the fan, and then remove the four screws securing the fan to the power supply housing.
5. Install the new fan on the power supply housing and connect the fan power cable.
6. Reinstall the power supply and close the base unit.

Internal Bay Fan

To replace the internal disk drive bay fan:

1. Open the base unit.
2. Disconnect the internal disk drive fan power cable.
3. Remove the four screws securing the fan to the internal disk drive bay at the rear of the unit. Note the airflow direction of the fan.



4. Install the new fan and connect the fan power cable.
5. Close the base unit.

Vertical Bay Fan

To replace the vertical disk drive bay fan:

1. Open the base unit.
2. Disconnect the fan power cable and remove the screw from the top of the fan bracket. For an illustration, refer to the “Vertical Bay Disk Drives” procedure earlier in this chapter.
3. Remove the fan from the fan bracket. Note the orientation of the fan.
4. Install the new fan on the bracket and install the bracket on the vertical disk drive bay.
5. Connect the fan power cable and close the base unit.

Speaker

A speaker is not installed in systems with the MSMT378 system board.

To replace the speaker:

1. Remove the face plate. Six screws on the front and one screw on each lower side secure the face plate to the system.
2. Remove the two screws securing the floppy drive to the power supply, and set the drive aside carefully.
3. Note the position of the red wire and disconnect the speaker cable connector from the system board.
4. Remove the screws that secure the speaker retaining ring to the power supply, and remove the ring and speaker. Access holes are provided on top of the power supply housing.
5. Place the retaining ring on top of the new speaker, insert the assembly into the power supply housing, and secure the ring with the screws.
6. Connect the speaker cable.
7. Attach the floppy disk drive.
8. Attach the face plate.

Lithium (CMOS/Clock) Battery

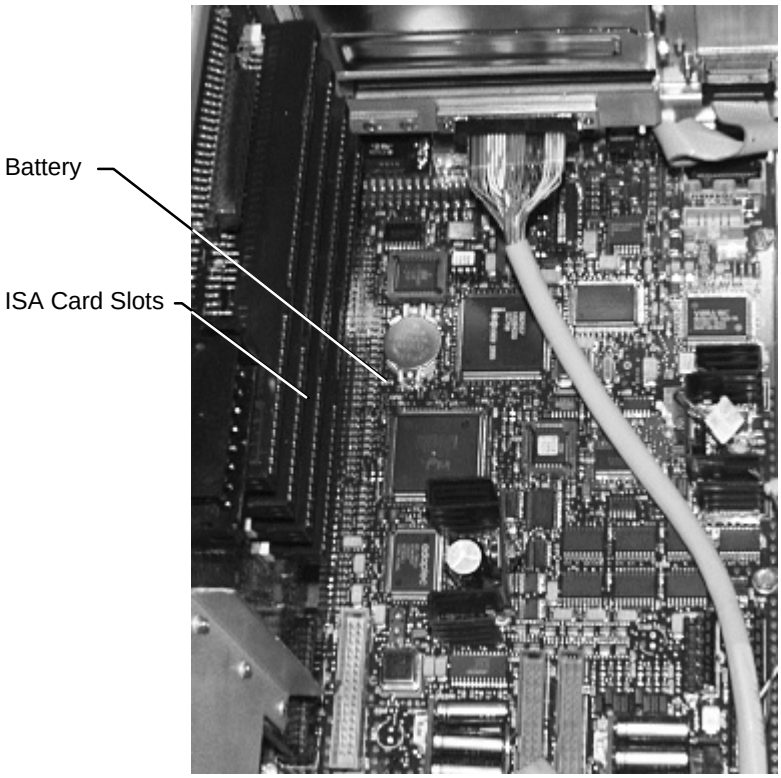
On the MSMT353 or MSMT359 system board, the battery is located to the right of the riser card, near the back. On the MSMT378 system board, the battery is located near the memory modules on the left side.

WARNING There is a danger of explosion if the battery is incorrectly replaced.

WARNING Replace the battery with the same or equivalent type only, as recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

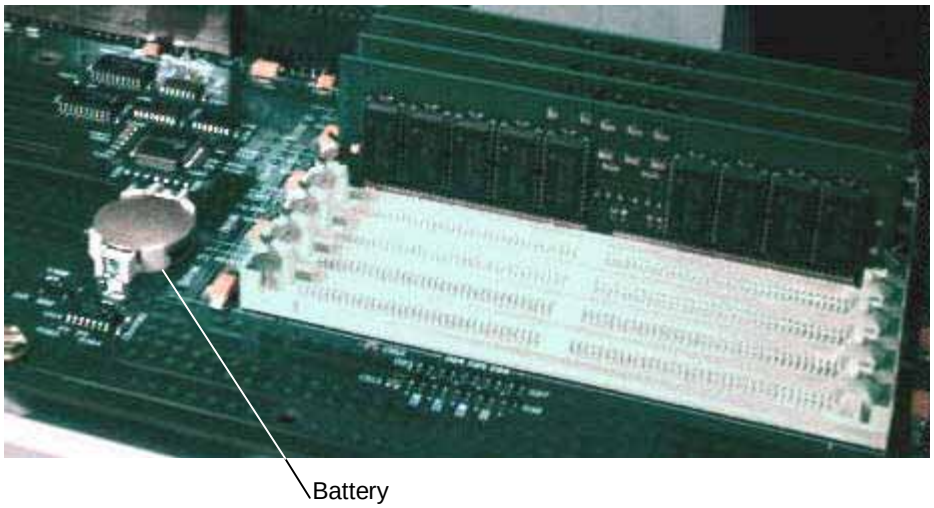
To replace the battery (on MSMT353 or MSMT359 system board):

1. Remove the ISA cards, if installed. (You must remove the internal drive bay if ISA cards are installed. Refer to "Installing an Option Board " in Chapter 3 for details).
2. Note the positive orientation of the battery. Carefully remove the discharged battery by grasping it firmly and lifting upward.
3. Install the new battery in the same orientation as the old battery.
4. Install the ISA cards and install the internal drive bay.
5. Dispose of the battery according to the manufacturer's instructions.



To replace the battery (on MSMT378 system board):

1. Remove any PCI cards that interfere with access to the battery.



2. Carefully remove the discharged battery by grasping it firmly and lifting upward.
3. Install the new battery in the same orientation as the discharged battery.
4. Replace the PCI cards that you removed in step 1 above.

AC Line Filter

You must remove the unit from the rack before replacing the AC line filter. This component ordinarily does not require replacement unless it has been damaged by current surges or other AC power problems.

WARNING Two people must remove the unit from the rack. Failure to do so can result in personal injury and equipment damage. The unit is heavy and difficult to handle.

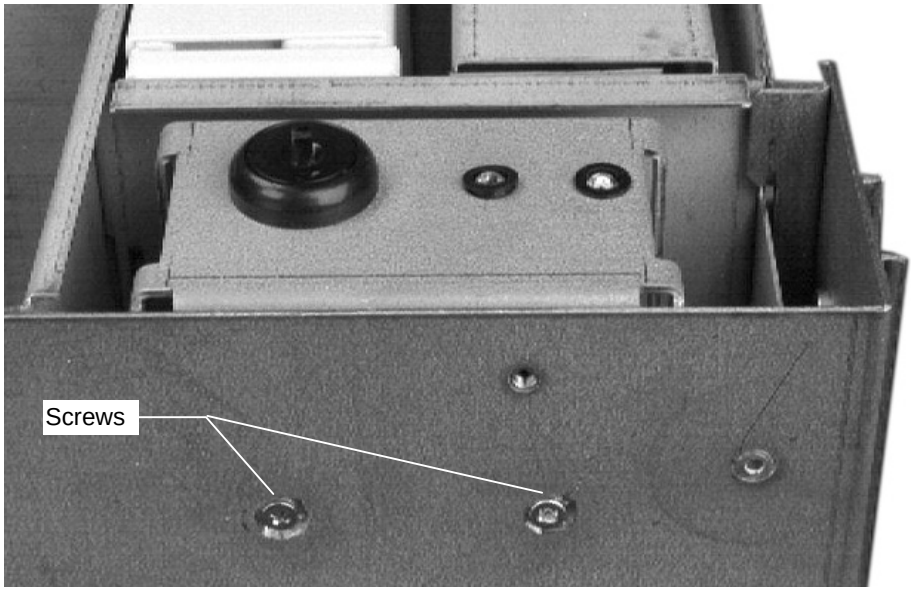
To replace the AC line filter:

1. Remove the unit from the rack. Use a helper!
2. Open the cover.
3. Disconnect the power cable from the top of the line filter.
4. Remove the right rail from the base unit.
5. Remove the four screws securing the line filter to the base unit.
6. Lift the line filter from the base unit.
7. Install the new line filter in the base unit and connect the power cable.
8. Install the right rail.
9. Install the cover.
10. Install the unit into the rack. Use a helper!

Keyswitch and LEDs

To replace the keyswitch:

1. Open the cover and remove the face plate as described in Chapter 1.
2. Remove the two screws securing the keyswitch and LED bracket to the base unit. The screws are underneath the base unit.



3. Pull the bracket forward slightly, note the location of the LED cables, and disconnect the cables.
4. Remove the keyswitch from the bracket.
5. Remove the keyswitch cable from the cable clip near the front of the system board, and disconnect the cable at the inline connector.
6. Install the new keyswitch with the arrow pointing up, place the keyswitch cable into the cable clip, and connect the cable at the inline connector.
7. Connect the LED cables and secure the bracket to the base unit.
8. Attach the face plate and install the cover.

To replace the LEDs:

1. Perform steps 1 through 4 above.
2. Remove both LEDs.
3. Install the two new LEDs.
4. Connect the LED cables and secure the bracket to the base unit.
5. Attach the face plate and install the cover.

3 Upgrading the System

This chapter describes adding memory, processors, option boards, internal SCSI drives, and external SCSI drives for all rack-mount systems.

NOTE Refer to Chapter 1 for details on opening the base unit and protecting against electrostatic discharge.

CAUTION Follow all warnings and cautions in servicing instructions. Personal injury and damage to equipment can occur if documented procedures are not followed.

CAUTION Use an antistatic wrist strap for all servicing procedures to avoid electrostatic discharge.

Adding Memory

You can upgrade memory on the MSMT353 or MSMT359 system board in 32 MB, 64 MB, 128 MB, and 256 MB increments; and the MSMT378 system board in 32 MB, 64 MB, and 128 MB increments. RenderRAX systems ship with all eight SIMM sockets populated.

Memory upgrade kits from Intergraph contain two SIMMs and a disposable antistatic wrist strap.

CAUTION System memory modules available from Intergraph have been certified for use with Intergraph computers at extremes of temperature and system load to ensure reliable performance. System memory modules available from other vendors may not function properly or reliably in your Intergraph computer.

To avoid damaging the SIMMs and voiding the warranty, take the following precautions.

- Do not bend, twist, drop, or otherwise handle the SIMMs carelessly.
- Do not expose the SIMMs to moisture or extreme temperatures.
- Do not remove the SIMMs from the antistatic bag until installation.

Follow these SIMM population rules to correctly install the SIMMs.

- Each bank has two slots. Fill both slots in a bank.
- Use the same size SIMM in both slots in a bank.
- After adding or replacing SIMMs, restart the computer. The new memory configuration is detected automatically.

The following table shows valid memory configurations. Each bank contains two sockets, and both sockets must be populated. Memory density must be the same in all populated sockets. NP designates the bank is not populated.

Supported Memory	Bank 0	Bank 1	Bank 2	Bank 3
64 MB	2 x 32 MB	NP	NP	NP
128 MB	2 x 64 MB	NP	NP	NP
	2 x 32 MB	2 x 32 MB	NP	NP
256 MB	2 x 128 MB	NP	NP	NP

Supported Memory	Bank 0	Bank 1	Bank 2	Bank 3
	2 x 64 MB	2 x 64 MB	NP	NP
	2 x 32 MB	2 x 32 MB	2 x 32 MB	2 x 32 MB
512 MB	2 x 128 MB	2 x 128 MB	NP	NP
	2 x 64 MB	2 x 64 MB	2 x 64 MB	2 x 64 MB
1 GB	2 x 128 MB	2 x 128 MB	2 x 128 MB	2 x 128 MB

To install the memory upgrade:

1. Open the base unit and remove the necessary parts as described in Chapter 1.
2. Remove the graphics boards and other installed PCI option boards.
3. Remove the existing SIMMs from their sockets before adding new ones.
4. Remove the SIMMs from the antistatic bag and install them in the following order:
   - For system board MSMT353 or MSMT359, if the total number of installed SIMMs will be four, install the SIMMs in the Bank 1 sockets first, then in the Bank 0 sockets.
   - For system board MSMT353 or MSMT359, if the total number of installed SIMMs will be eight, install the first SIMM in socket J58. Install the remaining SIMMs in the next empty socket until socket J51 is the last socket populated.
   - For system board MSMT378, install the first SIMM in the first available socket.
5. Position the SIMM in the next available socket so that the notch faces the back of the base unit.
6. Insert the SIMM at a 60 degree angle, pressing it firmly into the socket.
7. Push on the top edge of the SIMM until it snaps into the metal clips. The socket tabs must fit inside the mounting holes of the SIMM.
8. Repeat steps 5 through 7 for the remaining SIMMs.
9. Replace the graphics and PCI option boards and close the base unit.
10. Restart the system. The new memory is recognized automatically.

Adding Processors to MSMT353 or MSMT359

You cannot add processors to the MSMT353 system board, since it ships with quad processors. The MSMT359 system board allows you to upgrade a single processor to dual processors and dual processors to quad processors. For the MSMT378 system board, you can upgrade a single processor to dual processors and Pentium Pro to Pentium II.

Single to Dual Upgrade

Single to dual processor upgrade kits include a CPU with attached heat sink, a voltage regulator module (VRM), and a metal clip.

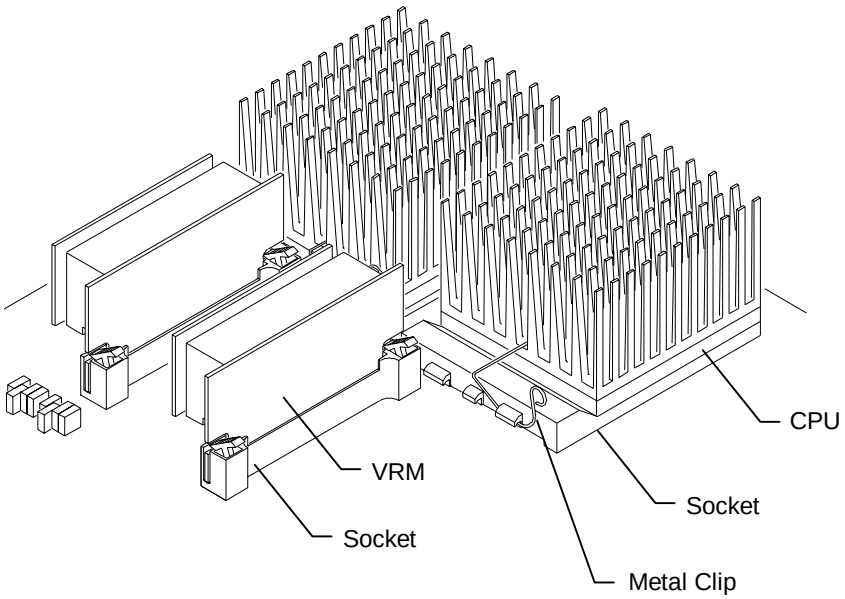
To upgrade a single processor system:

1. Open the base unit and remove the necessary parts as described in Chapter 1.

NOTE If full-length ISA option boards are installed, they must be removed to access the CPU sockets.

2. Find the empty processor socket (adjacent to the existing CPU) on the system board. Raise the lever on the empty socket to open the socket.
3. Install the new CPU into the socket. The CPU socket is keyed to ensure proper insertion.
4. Lower the lever to lock the CPU in the socket.
5. Attach the metal clip over the new CPU. Examine how the clip on the first CPU is installed to see how it should fit on the new CPU. Ensure each end of the clip fully engages the socket tabs.
6. Attach the VRM into the empty VRM socket. Ensure the release tabs in the VRM socket fully engage the VRM.

   The following figure shows the completed upgrade with the new CPU and VRM installed.



7. Replace any full-length ISA option boards and close the base unit.

Dual to Quad Upgrade

Dual to quad upgrade kits contain a processor module with two pre-installed processors and voltage regulator modules (VRMs), and screws.

To upgrade a dual processor system:

1. Open the base unit and remove the necessary parts as described in Chapter 1.

NOTE If PCI option boards are installed, remove to access the quad processor sockets.

2. Remove the P6 bus termination card. The processor module will be installed in this location.
3. Align the processor module with the sockets and carefully insert the module.
4. Press the processor module firmly into the sockets.
5. Remove the left VRM.
6. Secure the processor module with screws supplied in the kit.
7. Install the left VRM.
8. Install any PCI option boards and close the base unit.
9. Return the P6 bus termination card to the Intergraph Repair Depot.

Adding Processors to MSMT378

The MSMT378 system board allows you to upgrade the system from single to dual processors, and from Pentium Pro processors to Pentium II processors.

Single to Dual Upgrade

To install a new processor module:

1. Open the base unit and remove the ISA cards.
2. Set the frequency, if necessary, for the new processor by adjusting jumpers J47 through J50. Refer to Chapter 6, “System Board MSMT378,” for more information.
3. Align the new processor module over the S1 slot and firmly press it down into the slot.
4. If necessary, replace the top section of the heat sink support. Gently push the plastic support bar toward the four posts on the heat sink support assembly, until the bar snaps into place.
5. Reinstall the ISA cards and close the base unit.

Pentium Pro to Pentium II Upgrade

The Pentium Pro and Pentium II processors for the MSMT378 system board are housed in plastic processor modules, which have heat sinks attached to one side. When a Pentium II module is installed into an S1 slot, the heat sinks are supported at the bottom by a black plastic bar, which runs between the two bottom-most rows of heat sink fins. The support bar is connected to a support assembly via four posts.

WARNING **Setting processor voltage incorrectly may destroy the processor! Refer to Chapter 6, “System Board MSMT378,” for details.**

To upgrade Pentium Pro module with Pentium II module:

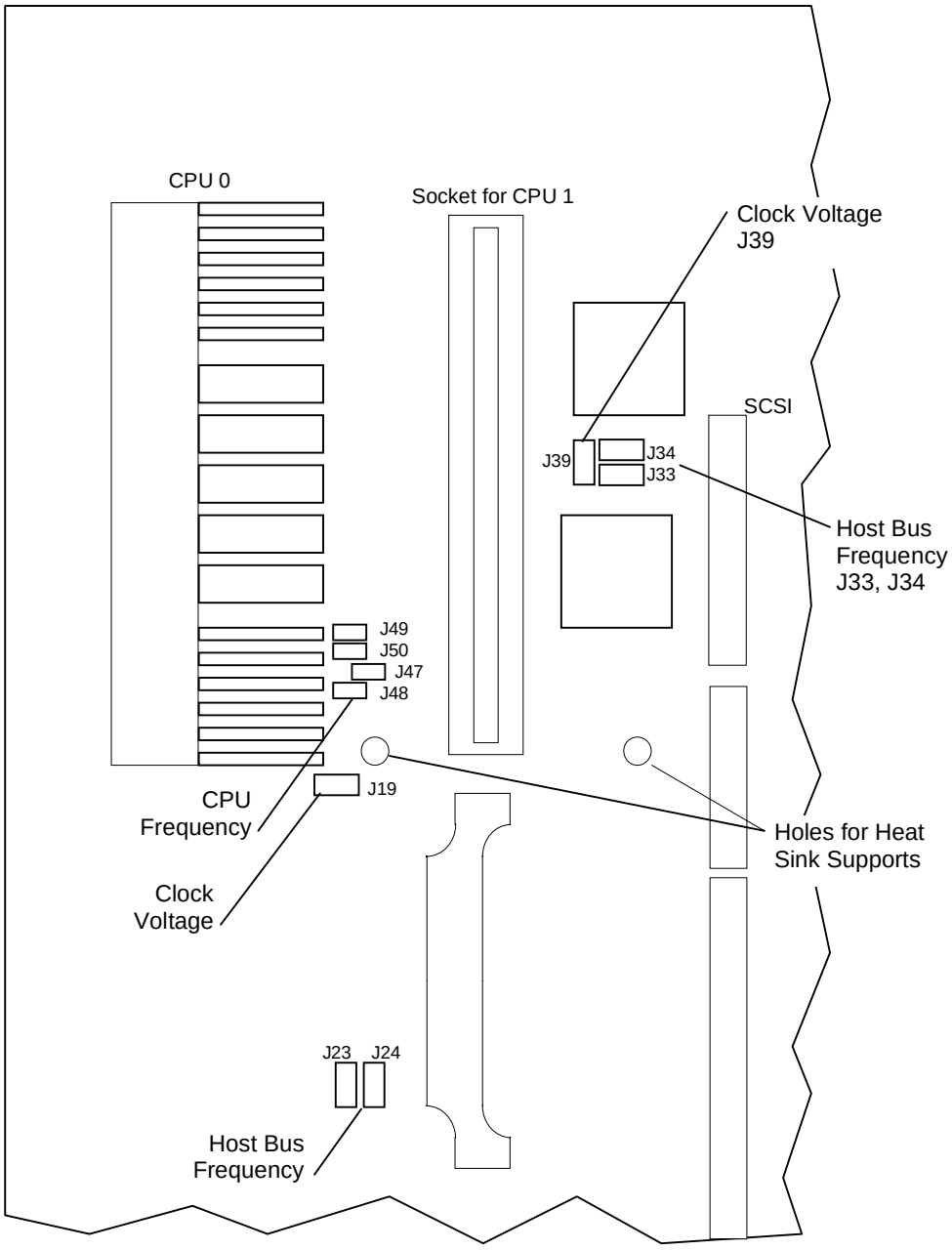
1. Open the base unit and remove ISA cards if installed.
2. Remove the top section of the heat sink support, if necessary. The plastic support bar has a tab on each end. Press both tabs inward, towards each other, while using a pulling motion to pull the

bar away from the heat sink fins. The support assembly is permanently connected to the system board, and need not be removed.

3. Remove the Pentium Pro processor module. Grasp both tabs on the top corners of the processor module and press them inward, towards each other. Then pull the entire module upward, keeping the tabs pressed inward. Heat sinks are permanently connected to the module, and need not be removed.

4. Remove the voltage jumper from J19, and place it on jumper J39. Refer to the following figure. Also refer to Chapter 6, "System Board MSMT378," for details on jumper settings.

5. Install the heat sink support assembly to the system board. The assembly snaps into place in two of the indicated holes. Refer to the following figure.



6. Reinstall the ISA cards and close the base unit.

Adding Option Boards

Peripheral Component Interconnect (PCI), non-compliant PCI, Industry Standard Architecture (ISA), and Plug-n-Play (PnP) option boards may be installed in the system. A general description of the types of boards is provided below.

- **PCI boards** contain configuration registers that define resource information to the system during startup. PCI boards do not require manual system configuration when installing the board. The system BIOS detects the board's presence during startup and reads information from the board's configuration registers to assign the necessary system resources. The system's PCI slots are limited to 25 Watts power dissipation per the *Peripheral Component Interconnect Specification, 2.1*. Installed PCI boards must draw less than 25 Watts of power. Also, the total power consumed by all PCI boards in the system should be less than 180 Watts.

NOTE All PCI option boards sold by Intergraph fully comply with the *Peripheral Component Interconnect Specification, 2.1.*

- **Non-compliant PCI boards** mechanically comply with the *Peripheral Component Interconnect Specification 2.1*, but do not contain configuration registers that allow the system to automatically assign the necessary resources. These boards install in PCI slots, but you assign system resources manually using the System Configuration Utility (SCU) before installing the board. In this regard, they are like ISA boards, as described below.
- **ISA boards** do not contain registers that define the resource information to the system during startup. Therefore, you must run the SCU to define the board to the system before installing the ISA board. This reserves system resources for the board and prevents conflicts with ISA option boards already installed. Refer to the section, "Assigning System Resources" later in this chapter.
- **PnP boards** are ISA boards that contain configuration registers like PCI boards. During startup, the system BIOS automatically detects the installed board and assigns the necessary system resources. Since PnP boards are ISA-based boards, they must be installed in the ISA slots.

PCI slots are on Side One of the riser card; ISA slots are on Side Two.

NOTE Assign system resources for ISA and non-compliant PCI boards before installation. Refer to the section, "Assigning System Resources" later in this chapter.

Installing an Option Board

To install option boards:

1. Open the base unit as described in Chapter 1. If installing an ISA card, the internal disk drive bay must be removed to access ISA slots. Refer to "Internal Bay Disk Drives" in Chapter 2 for instructions on removing the internal disk drive bay.
2. Using a quarter-inch nutdriver, remove the blanking plate from an available slot. If installing a PCI card, loosen the two screws securing the board clip to the PCI card guide (just behind the power supply), and slide the board clip forward.
3. Install the option board. Press firmly to ensure the board seats completely into the slot.
4. Secure the board to the chassis using the screw removed previously. If installing a PCI card, slide the board clip back and tighten the two screws.
5. Connect any cables to the board as required by the manufacturer.
6. Close the base unit and restart the system.

NOTE For PnP boards, notice when the following message displays: `Hit DEL if you want to run SETUP`. Press DELETE to run AMIBIOS Setup, and enable the Boot to PnP Operating System parameter under PnP Setup menu. Exit AMIBIOS Setup and restart the system.

Assigning System Resources

Some option boards include a configuration diskette that you can use to reserve the system resources required for the board. Other option boards do not include a diskette, but require that you manually enter the configuration information. The next two sections describe how to reserve the resources for both types.

The System Configuration Utility (SCU) is an MS-DOS utility that will not run in the Windows NT environment. Use the System Utilities (SYSUTIL) diskette delivered with your system to boot the system into MS-DOS. The system must be set to boot from the floppy disk drive (normally drive A) to use the SCU. If necessary, refer to "Changing the System Boot Sequence" in the *System Setup*.

NOTE For a list of available system address resources (DMA, I/O, memory) refer to Chapter 5 or 6.

NOTE Treat non-compliant PCI boards and PC Cards as ISA boards for assigning system resources.

Option Boards with a Configuration File

Some ISA boards are shipped with a diskette containing a configuration file. The configuration file can be loaded to the system so that the BIOS reads this file to assign resources during startup. If you install ISA boards that are shipped with a configuration diskette, follow this procedure.

NOTE If a configuration diskette is not delivered with the option board, refer to "Option Boards without a Configuration File."

To configure option boards with a configuration file:

1. Shut down and power off the system.
2. Insert the SYSUTIL diskette into the floppy diskette slot of the combo drive; then restart the system.
3. When the MS-DOS Startup menu displays, select option 1 to run the SCU.
4. Use the arrow keys or the mouse to select Step 2 from the SCU Main Menu. Then press INSERT to add a board that was not detected or has not been installed.

   A prompt displays requesting you to copy the configuration files needed to configure the system. The configuration file is on a diskette provided by the ISA board manufacturer.
5. Press ENTER to accept A:\ as the path to the configuration file.
6. Select the slot where the board will be installed. Slots 1 through 4 are valid for ISA boards, slots 1 through 12 are valid for PCI boards.
7. When prompted to insert the source disk, insert the diskette containing the configuration file and press ENTER.
8. When prompted to insert the destination disk, insert the SYSUTIL diskette and press ENTER. The configuration file from the option board manufacturer will be installed to the system and to the SYSUTIL diskette.
9. Press ESC to return to the SCU Main Menu.

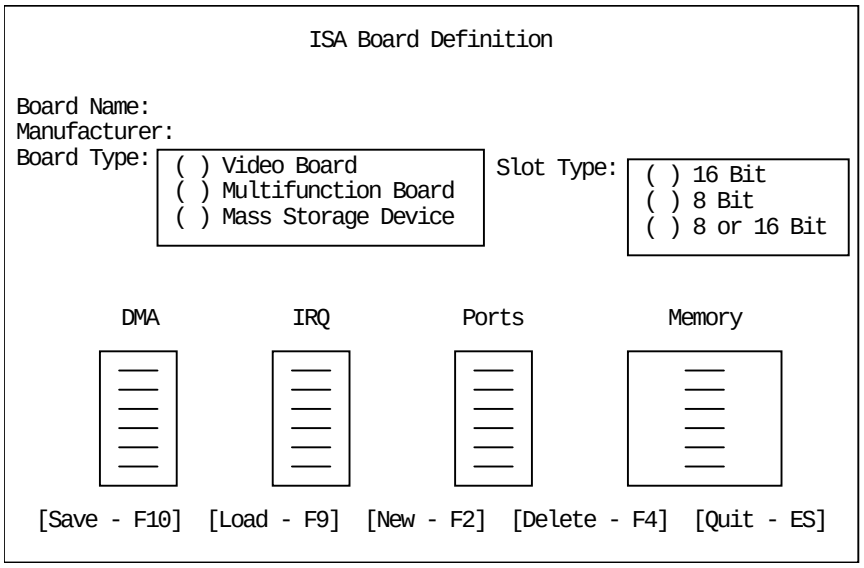
10. Select Step 4 of the SCU Main Menu to save the configuration, and then select Step 6 of the SCU Main Menu to exit the SCU.
11. Remove the diskette from the combo drive and shutdown the system.
12. Install the option board as described in "Installing an Option Board" previously in this chapter.
13. Restart the system.

Option Boards without a Configuration File

Some board vendors do not include configuration files with their boards. For these boards, you must use the System Configuration Utility (SCU) to define the board to the system.

To configure option boards without a configuration file:

1. Shut down and power off the system.
2. Insert the SYSUTIL diskette into the floppy diskette slot of the combo drive; then restart the system.
3. When the MS-DOS Startup menu displays, select option 1 to run the SCU.
4. From the SCU Main Menu, select Step 2, then press F6. The ISA Board Definition Menu displays as shown in the following figure.



5. Enter the data specified in the manufacturer's configuration instructions.

NOTE Use the TAB and arrow keys to move the cursor from field to field. Once inside the DMA, IRQ, and Ports fields, press ENTER to display the sub-fields for entering the information.

6. Press F10 to save the data to the system.
7. Press ENTER to return to the ISA Board Definition Menu.
8. Press ESC to return to the SCU Main Menu.
9. Select Step 2 of the SCU Main Menu. The Add and Remove Boards Menu displays.
10. Select the required slot number and press INSERT.
11. Select INSERT again to add the board. The ISA Board Database Menu displays.
12. Select the correct board name and press ENTER.

13. When the Slot Selection Menu displays, select the required slot and press ENTER.
14. Press ESC to return to the SCU Main Menu.
15. Select Step 4 of the SCU Main Menu to save the configuration.
16. Select Step 6 of the SCU Main Menu to exit the SCU.
17. Remove the diskette from the combo drive and shutdown the system.
18. Install the option board as described in "Installing an Option Board" previously in this chapter.
19. Restart the system.

NOTE If you assign resources for a new board that are assigned to a previously installed board, then the message `Static Resource Conflict` displays during boot up. Use AMIBIOS Setup to change the resources so the boards do not conflict with each other.

Adding Internal SCSI Drives

The front of the system allows four 5.25-inch drives to be installed—two drives in the horizontal bay and two in the vertical bay. There is also an internal bay that accepts two 3.5-inch drives.

- In StudioZ RenderRAX workstations and InterServe 615R and 625R servers, one disk drive is installed in the left slot of the vertical bay. A CD-ROM is installed in the lower slot of the horizontal bay. The two internal drive bays are empty. The disk drive uses SCSI ID 0 and the CD-ROM drive uses SCSI ID 4.
- In the TDZ-425 RAX and TDZ-612 RAX, one removable disk drive module is installed in the left vertical bay. A CD-ROM drive is installed in the lower horizontal bay. The two internal drive bays are empty. The disk drive uses SCSI ID 0, the SCSI CD-ROM drive in the TDZ-612 RAX drive uses ID 4, and the EIDE CD-ROM in the TDZ-425 RAX uses the primary EIDE bus and the mode select header is set to "Master."

The Adaptec AIC-7880 controller on the riser card provides Ultra Wide SCSI for internal drives in all rack-mounted systems.

When installing a SCSI drive, have the vendor's documentation available to follow instructions for setting SCSI IDs for SCSI drives, installing device drivers when required, and configuring other drive attributes necessary for operation.

If installing a drive that connects to an adapter card (such as an EIDE drive), refer to the vendor's documentation for installing the adapter card and required cables. The previous section, "Adding Option Boards," provides information about PCI and ISA slot locations in the system.

If installing a Kingston removable disk drive module, refer to the vendor's documentation for installing the module, removing terminators, and setting the SCSI ID.

If installing a Fast SCSI (Narrow) drive, use the 68 pin to 50 pin adapter (CCON401B), provided with the system. If you install a non-Wide SCSI device, the data transfer rate is limited to that device's speed.

Refer to Chapter 9, "Peripherals," for details on drive configurations, jumpers, and cables.

NOTE Internal SCSI drives are not terminated. The internal SCSI cable provides termination. You must remove termination from any drive that you install in the system.

SCSI IDs should be set for the drives using the following guidelines:

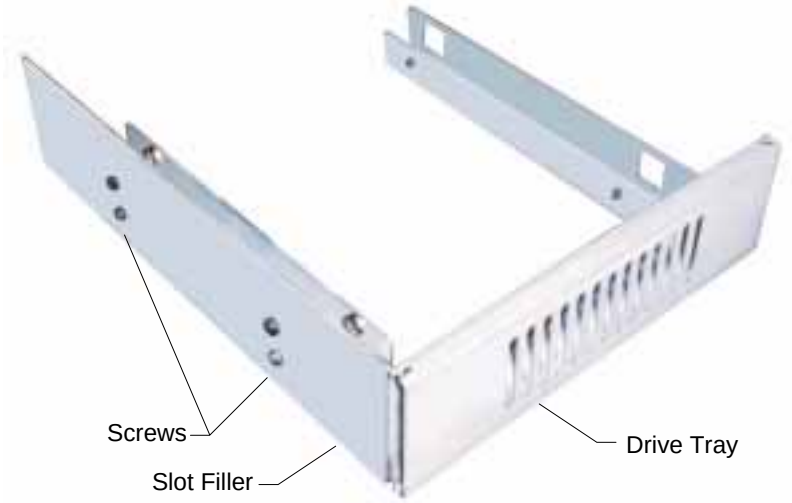
Slot Location	Drive	SCSI ID
Left Vertical	System disk drive	0
Right Vertical	Add-on disk drive	1
Left Internal	Add-on disk drive	2
Right Internal	Add-on disk drive	3
Lower Horizontal	CD-ROM drive	4
Upper Horizontal	Other drive type	5 or 6

To install a drive into the internal drive bay:

1. For SCSI devices, disable the SCSI termination, and set the SCSI ID for the drive to an unused number.
2. Remove the top cover from the base unit as described in Chapter 1.
3. Disconnect the fan power cable. Note the location where the fan power cable connects to the system board.
4. Remove the two screws that secure the internal bay to the base unit.
5. Slide the internal bay toward the front until it disengages; then lift it out of the system.
6. Install the disk drive and secure it with four screws (two on top and two on bottom). Refer to "Disk Drives in the Internal Bay," in Chapter 2, for an illustration.
7. Place the internal bay into the base unit, and slide it toward the rear until it engages.
8. Attach the bay to the base unit.
9. Connect the fan power cable to the system board.
10. Connect the power cable and SCSI cable to the disk drive. The connectors are keyed to ensure proper insertion.
11. Close the base unit.

To install a drive into the front vertical slots:

1. For SCSI devices, disable the SCSI termination, and set the SCSI ID for the drive to an unused number.
2. Remove the top cover from the base unit as described in Chapter 1.
3. Remove the drive tray from the slot. Two screws on top of the vertical bay secure the drive tray.
4. If installing a 3.5-inch drive that uses removable media (such as a 4 mm DAT drive), mount the drive to an adapter that increases the mounting size to 5.25 inches.
5. Disk drives are mounted to the drive tray removed in step 3. Remove the slot filler from the drive tray as shown in the following figure.



6. Set the drive into the tray and secure it with two screws on each side.

7. Attach the slot filler to the drive tray.
8. Slide the drive into the slot and secure it to the vertical bay.
9. Remove the disk drive fan.
10. Connect the power cable and SCSI cable to the drive.
11. Replace the disk drive fan.
12. Close the base unit and restart the system.
13. If necessary, install the appropriate device driver and configure the device according to the vendor's instructions.

To install a drive into the front horizontal slots:

1. For SCSI devices, disable the SCSI termination, and set the SCSI ID for the drive to an unused number.
2. Remove the top cover from the base unit as described in Chapter 1.

3. Remove the two screws that secure the horizontal bay to the system. Refer to “CD-ROM Drive” in Chapter 2 for an illustration.
4. Pull the horizontal bay back about an inch and lift it out of the system.
5. Remove the two screws that secure the top drive tray on each side of the horizontal bay, and remove the tray. Refer to “CD-ROM Drive” in Chapter 2 for an illustration.
6. If installing a 3.5-inch drive that uses removable media (such as a 4 mm DAT drive), mount the drive to an adapter that increases the device size to 5.25 inches.
7. Disk drives are mounted to the drive tray removed in step 5.
8. Place the drive into the tray and secure it with two screws on each side.

9. Slide the tray into the drive bay and secure it with two screws on each side.
10. Place the drive bay into the system and secure it with the screws.
11. Connect the SCSI cable and power cable to the new drive.
12. Close the base unit.

Adding External SCSI Drives

You can add single-ended external SCSI drives to the system by connecting them to the SCSI port on the back of the base unit. Additional SCSI option boards (adapters) can be installed to support external SCSI drives as well. The section “Adding Option Boards” earlier in this chapter describes installing new boards.

The Adaptec AIC-7860 SCSI controller (on MSMT353, MSMT359 and MSMT378 system boards) provides the Ultra SCSI bus for external devices.

SCSI Cable Guidelines

If you are using a SCSI adapter card, this information also applies.

The number of drives and length of the cables used to connect the drives becomes a factor when using SCSI-1, Fast SCSI (SCSI-2), Ultra SCSI, and Ultra Wide SCSI drives. Fast SCSI, Ultra SCSI, and Ultra Wide SCSI impose shorter cable restrictions than SCSI-1. The total length of the SCSI cabling must not exceed the following:

Drives	SCSI-1	Fast SCSI-2	Ultra SCSI	Ultra Wide SCSI
1 to 4	19.8 feet (6 meters)	9.9 feet (3 meters)	9.9 feet (3 meters)	9.9 feet (3 meters)
5 to 7	9.9 feet (3 meters)	9.9 feet (3 meters)	4.5 feet (1.5 meters)	4.5 feet (1.5 meters)

NOTE The SCSI controller (on the system board or an adapter card) counts as one device.

The total length of the SCSI cabling is the sum of the following:

- SCSI cable inside the base unit - 6.0 inches (15 cm)
- SCSI cable inside each device - average 8 inches, (20 cm)
- SCSI cable between the base unit and the first device
- SCSI cable between each device

Connecting the Drive

To add an external SCSI drive:

1. Connect the SCSI cable to the SCSI port on the base unit and to the device.
2. Set the drives SCSI ID to an unused number (1, 2, 3, 5, or 6). By default, the following devices use these SCSI IDs:
   - System disk drive uses ID 0.
   - CD-ROM drive uses ID 4.
   - SCSI bus uses ID 7.
3. Disable or enable the drive's SCSI termination according to the vendor's instructions. The last external drive on the SCSI cable chain must have SCSI termination enabled. All other external drives must have SCSI termination disabled.
4. If necessary, install the software drivers and configure the drive according to the vendor's instructions.

Disabling Sync Negotiation

Use the following instructions if you need to disable the sync negotiation, which forces the controller to transfer data at a specified rate (slower than its capability) for the target drives.

To disable sync negotiation:

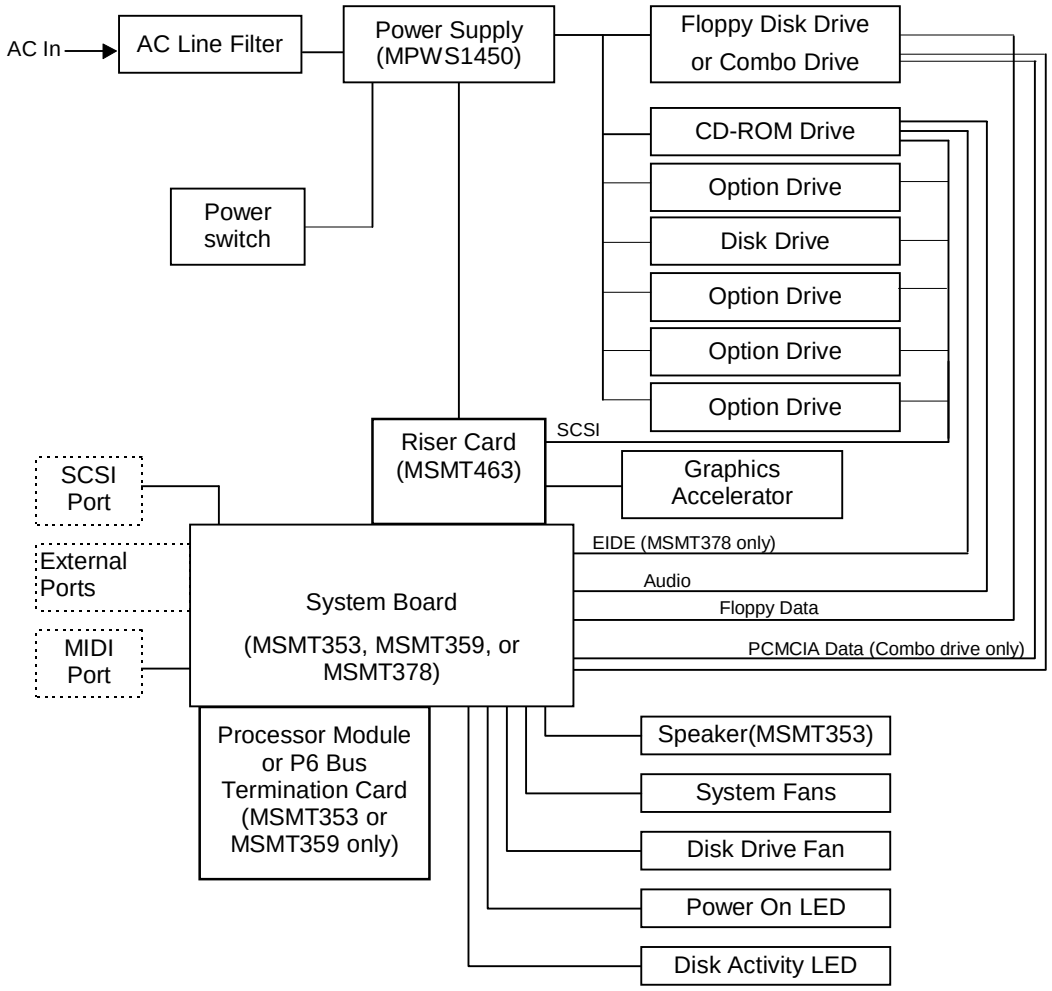
1. Power off the system and reboot into DOS using the SYSUTIL diskette.
2. From the SYSUTIL main menu, select `SCSISelect Utility`.
3. From the `Options` box, select `Configure/View Host Adapter Settings`.

4. Select the SCSI Device Configuration option.
5. Change the Initiate Sync Negotiation values for all the attached SCSI drives (represented by their SCSI ID number) to no.
6. Set the Maximum Sync Transfer Rate values for the drives to the desired settings. If changing these settings to extend cable lengths or add more devices, set Fast SCSI-2 drives to 8.0. (or less if available).
7. Press ESC until the Exit Utility dialog displays. Select Yes and press ENTER.
8. Press any key to restart the system.

4 System Hardware Overview and Specifications

This chapter contains general, technical information about the hardware included in the following rack-mounted systems: TDZ-425 RAX, TDZ-612 RAX, StudioZ RenderRAX, InterServe 615R, and InterServe 625R.

Functional Diagram



System Board Combinations

The following table differentiates the rack mount workstation and server systems. All use the same chassis, but are configured with a different system board.

RenderRAX	TDZ-612 RAX	TDZ-425 RAX	InterServe 615R/625R
MSMT359 system board	MSMT353 system board	MSMT378 system board	MSMT359 system board
MSMT463 riser card	MSMT463 riser card	MSMT463 riser card	MSMT463 riser card

System Board Feature Summary

The following table summarizes the SCSI, memory, and processor features of the system boards. Refer to Chapter 5 for details on MSMT353 or MSMT359 and Chapter 6 for MSMT378.

Board	SCSI	Memory	Processors
MSMT353 or MSMT359 system board	Adaptec AIC-7860 controller (external) Ultra SCSI	1 GB Maximum 8 slots in 4 banks 70 ns DRAM 4-way interleave	Dual or Quad 200 MHz Intel Pentium Pro
MSMT378 system board	Adaptec AIC-7860 controller (external) Ultra SCSI	512 MB Maximum 8 slots in 4 banks 60 ns ECC EDO No interleave	Single or Dual 266 MHz Intel or 300 MHz Intel Pentium II or 200 MHz Intel Pentium Pro

System Boards Component Specification

The following table summarizes the main component specifications of the available system boards.

Component	MSMT353 or MSMT359	MSMT378
System BIOS	Quad-processor systems: American Megatrends BIOS core 782 Single and dual processor systems: American Megatrends BIOS core 752	American Megatrends BIOS core 800
Processor(s)	Intel Pentium Pro	Intel Pentium Pro or Pentium II
Host Bridge	Intel P6 Bus-to-PCI Bridge chip (OPB) and memory controller (OMC). PCI bus compliant to PCI Bus Specification revision 2.0	Intel P6 Bus-to-PCI Bridge chip (OPB) and memory controller (OMC). PCI bus compliant to PCI Bus Specification revision 2.0
Sound Controller	Creative Labs Vibra 16C, MPC 2.0 compliant	Crystal CS4236B, PC97 compliant
Ethernet Controller	Intel 82557 10/100BaseTX PCI	Intel 82557 10/100BaseTX PCI
SCSI Controller	Adaptec AIC-7860 (Ultra SCSI external port)	Adaptec AIC-7860 (Ultra SCSI external port)
Peripheral Controller	Standard Microsystems FDC37C932	Standard Microsystems FDC37C932
PCI-to-ISA Bridge	Intel 82379AB	Intel 82371SB PCI/ISA IDE Xccelerator (PIIX3)
EIDE Controller	Not Applicable	Intel 82371SB PCI/ISA IDE Xccelerator (PIIX3)
Universal Serial Bus Ports	Not Applicable	12 MBit per second transfer rate
Onboard Video	G95	Not Applicable

Riser Card Features

The following table summarizes the main features of the riser card.

Component	MSMT463
PCI Slots	6 (side 1)
ISA Slots	4 (side 2)
SCSI Controller	Adaptec AIC-7880P (Wide Ultra SCSI internal)

System Model Number

The model number on the back of the base unit identifies the system hardware configuration. The following table defines the individual digits.

Digit	Meaning	
1: Series	Y:	Rack-mount system
2: Processor Type	F:	Quad P6 200 MHz CPU; 256 KB cache
	G:	Dual P6 200 MHz CPU (Quad ready); 256 KB cache
	H:	Single P6 200 MHz CPU; 256 KB cache
	J:	Dual P6 200 MHz CPU; 256 KB cache
	N:	Single 200 MHz CPU (Quad ready); 512 KB cache
	P:	Dual P6 200 MHz CPU (Quad ready); 512 KB cache
	Q:	Quad P6 200 MHz CPU (Quad ready); 512 KB cache
	V:	Dual PII 266 MHz CPU
3. Graphics	0:	No graphics
	5:	G95, 2 MB WRAM
	Q:	Z13
	R:	Z25
	S:	Z13 with 32 MB texture memory
	T:	Z25GT with 64 MB RAM
	U:	G76 with 1 MB RAM
	V:	G76 with 2 MB RAM
	Y:	V25
4: Chassis	0:	Workstation
	1:	InterServe
	N:	TDZ-610 with Internal RAID disk array
	Q:	StudioZ
	V:	with Kingston Removable Drive Module
	W:	StudioZ RenderRAX
	X:	with Kingston Removable Ultra Wide Drive Module
5: Memory	0:	No memory
	2:	8 MB
	3:	16 MB
	4:	32 MB
	6:	64 MB
	7:	128 MB
	9:	256 MB
	A:	24 MB
	B:	512 MB
	C:	1 GB

Digit	Meaning	
6: Peripheral Drives	0:	No CD-ROM drive and no floppy disk drive
	1:	Floppy disk drive and no CD-ROM drive
	2:	Combo drive and no CD-ROM drive
	3:	CD-ROM drive and floppy disk drive
	4:	CD-ROM and combo drive
7: Disk Drives	0:	No hard disk drive
	3:	2 GB
	4:	4 GB
	7:	2 GB w/4 GB AV drive (StudioZ)
	9:	9 GB
	L:	4 GB w/4 GB AV drive (StudioZ)
8: Operating System	0:	No operating system
	1:	DOS/Windows
	2:	Windows NT Workstation
	3:	Windows 95
	4:	Windows NT Server, phase III
	7:	Windows NT Server, phase II
	9:	Solaris
	A:	Windows NT Workstation/Solaris
9: Revision	Variable	

Specifications

Base Unit Dimension (HxWxD)	Base Unit Weight	Maintenance Clearance
8.75 x 16.65 x 25.25 inches (22.2 cm x 42.3 cm x 64.1 cm) without rails, handles, and cables	64 lb (140.8 kg) without rails	36 inches (91.4 cm) front and back

Electrical				Power Consumption
AC line voltage:	Frequency:	Phase:	Rated receptacle current:	539 Watts (based on 120 VAC, 60 Hz)
90-132 VAC	47-63 Hz	1-phase	15-amp, 125V	
180-264 VAC	47-63 Hz	1-phase	15-amp, 250V	

Environmental Recommendations	Environmental Impact
Ambient room temperature, operating: 50° to 80° F (10° to 26° C) Relative Humidity, operating: 20 to 80% (non-condensing)	Heat Dissipation: 1878 BTUs/hour (7.88 kcals/min)

Optional Hardware

If your system includes any of the following hardware, refer to the documentation delivered with that hardware for additional information:

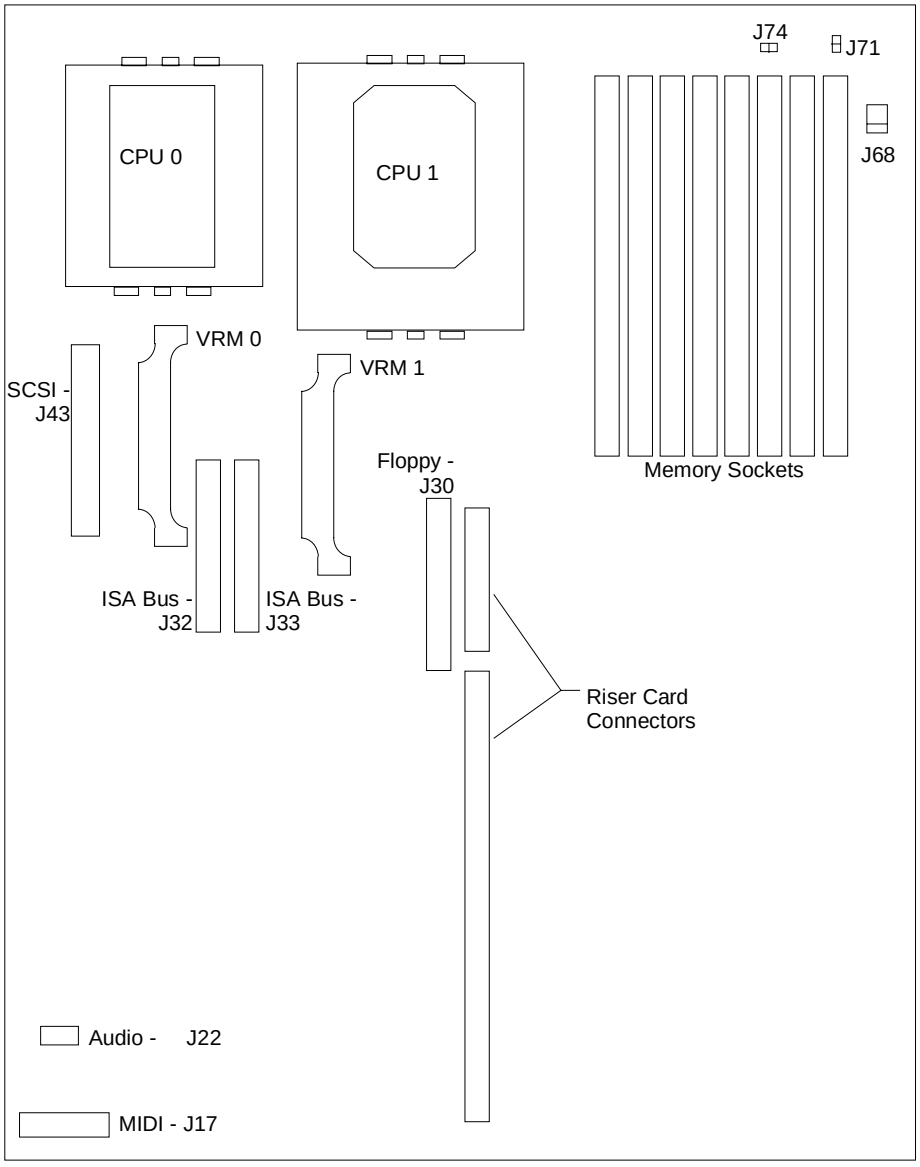
- Monitors
- Concentrator
- Removable disk drives
- Uninterruptible power supply
- RealiZm graphics (TDZ-425 RAX and TDZ-612 RAX only); G95 card (RenderRAX only)

5 System Board MSMT353 and MSMT359

This chapter provides information about board connectors, the sound controller, and address resources for the MSMT353 and MSMT359 system boards, which use Pentium Pro processors. Refer to “Board Combinations” in Chapter 4 for information on which system boards are used in the various workstations and servers.

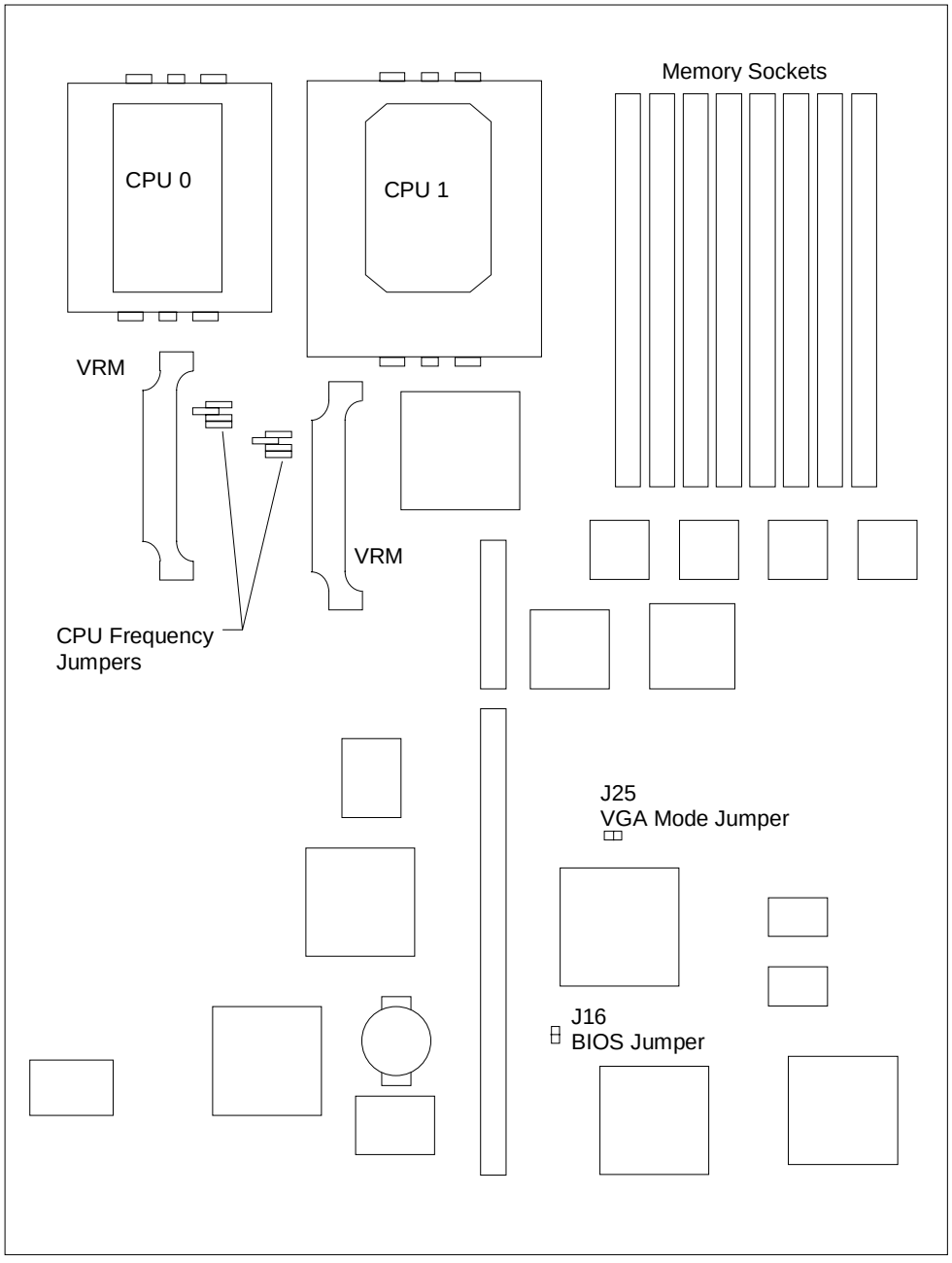
Connectors

The following figure shows the internal connector locations.



Jumpers

The system board uses jumpers to set the CPU frequency, enable or disable G95 VGA mode (MSMT359 only), and clear the BIOS password.



CPU Frequency

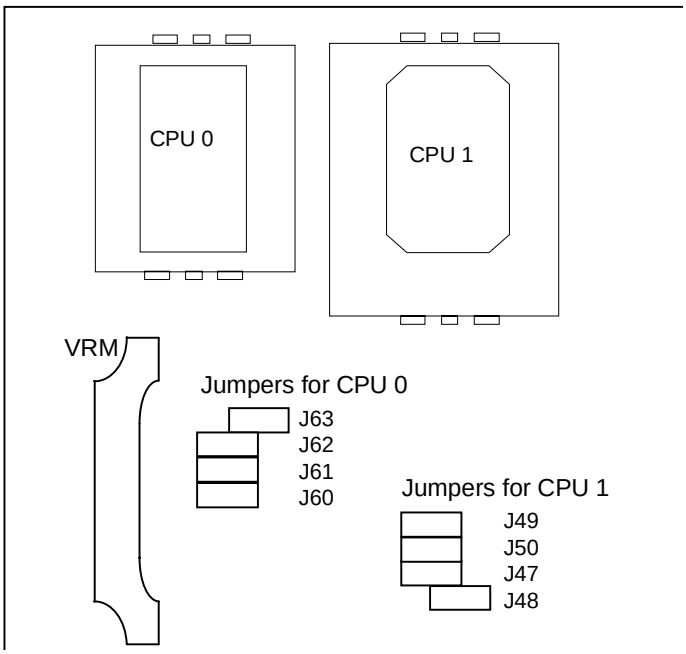
The 180 MHz CPU uses a 60 MHz P6 bus, with jumpers installed to obtain the 3x multiplier. The 200 MHz CPU uses a 66.67 MHz P6 bus, with jumpers installed to obtain the 3x multiplier.

CAUTION Do not change the jumper settings in an attempt to change CPU speed. The CPUs will only operate properly when the jumpers are installed in their default settings.

The following tables show jumper settings for CPU frequency multipliers. Settings are identical for 180 MHz and 200 MHz CPUs. IN denotes the jumper is installed on both pins.

CPU 0 Frequency		CPU 1 Frequency	
Jumper	**Setting**	**Jumper**	**Setting**
J63	OUT	J49	IN
J62	IN	J50	IN
J61	IN	J47	IN
J60	IN	J48	OUT

The following figure shows the detail of the CPU frequency jumpers.



VGA Mode

J25 on the system board enables or disables the VGA mode for the graphics accelerator. If the jumper is not installed (default), the VGA mode is enabled. If the jumper is installed, the VGA mode is disabled. You must remove the PCI option boards and the processor module (or P6 bus termination card) to access J25.

NOTE The jumper is absent if the system board does not feature onboard G95.

BIOS Password Clear

J16 on the system board enables or disables the BIOS password stored in CMOS RAM. If the jumper is not installed (default), the password (if present) is enabled. If the jumper is installed, the password is cleared, allowing the AMIBIOS Setup program to be accessed without a password. You must remove the PCI option boards and the processor module (or P6 bus termination card) to access J16.

Cable Routing and Pinouts

From	Cable	To
J12, Fan Power	MCBLZ660	Internal bay disk drive fan
J17, MIDI	MCBL038A	External MIDI port
J22, Audio	MCBLZ630	CDSK132 CD-ROM drive
J30, Floppy	MCBLZ380	CDSK102 Floppy disk drive or MESAM86 Combo drive
J43, SCSI	MCBLZ176A	External SCSI drives
J68, Fan Power	MCBLZ530	System Fans (2)
J69, Fan Power	MCBLZ660	Vertical bay disk drive fan
J71, Speaker	MCBLW660	Speaker
J72, Power On LED	MCBLZ610	Power On LED
J73, Disk Activity LED	MCBLZ620	Disk Activity LED

NOTE The following connectors and cables are used if the combo drive MESAM86 is installed in the system, in place of the floppy disk drive CDSK102.

From	Cable	To
J32, ISA Bus (PCMCIA)	MCBL084A	MESAM86 Combo drive, J6
J33, ISA Bus (PCMCIA)	MCBL084A	MESAM86 Combo drive, J3

J17, MCBL038A, MIDI

Pin	Signal	Pin	Signal	Pin	Signal
1	+5V	6	Y-axis, joystick 1	11	X-axis, joystick 2
2	Fire button 0	7	Fire button 1	12	MIDI out
3	X-axis, joystick 1	8	+5V	13	Y-axis, joystick 2
4	Ground	9	+5V	14	Fire button 3
5	Ground	10	Fire button 2	15	MIDI in

J22, MCBLZ630, Audio

Pin	Signal
1	Right Sound Channel
2	Ground
3	Left Sound Channel
4	Ground

NOTE The MCBLZ630 cable is used when the Panasonic CD-ROM drive is used in the system. If the Sony CD-ROM drive is used, then the cable MCBLZ220 is installed. The pinout for the cables is the same.

J30, MCBLZ380, Floppy

Pin	Signal	Pin	Signal	Pin	Signal
2	RPM	14	DRV0-	26	TRK0-
4	No connect	16	MTR1-	28	WRPRT-
6	DRATE0	18	DIR	30	RDATA-
8	INDEX-	20	STEP-	32	HDSEL
10	MTR0-	22	WDATA-	34	DSKCHG
12	DRV1-	24	WGATE-		

NOTE All odd-numbered pins of J30 are connected to ground, except pin 29 (MID1) and pin 33 (MID0).

J43, MCBLZ176A, SCSI

Pin	Signal	Pin	Signal	Pin	Signal
26	CD0	33	CD7	46	MSG
27	CD1	34	CD Parity	47	SCT
28	CD2	38	TPWR	48	CMD
29	CD3	41	ATTN	49	REQ
30	CD4	43	BSY	50	I/O
31	CD5	44	ACK	Remaining	Ground
32	CD6	45	RST		

J68, MCBLZ530, Fan power

Pin	Signal	Color
1	+12V	Red
2	Ground	Black

J12 and J69, MCBLZ660, Fan power

Pin	Signal	Color
1	+12V	Red
2	Ground	Black

J71, MCBLY520, Speaker

Pin	Signal	Color
1	+ 5.1 V	Red
2	Ground	White

J72, MCBLZ610, Power On LED

Pin	Signal	Wire Color
1	Pwrgood	Red
2	Ground	Black

J73, MCBLZ620, Disk Activity LED

Pin	Signal	Wire Color
1	DiskActive	Orange
2	Ground	Black

J32, MCBL084A, PCMCIA ISA Bus

Pin	Signal	Pin	Signal	Pin	Signal
1	IRQ15	15	SD+(0)	28	Ground
2	IRQ14	16	SD+(1)	29	RSTDRV
3	IRQ10	17	SD+(4)	30	Ground
4	IRQ3	18	SD+(5)	31	SA+(6)
5	IRQ7	19	MEMW-	32	SA+(7)
6	IRQ9	20	MEMR-	33	SA+(10)
7	IOCS16-	21	SA+(17)	34	SA+(11)
8	Ground	22	SA+(18)	35	SA+(14)
9	IOCHRDY+	23	SA+(21)	36	SA+(15)
10	Ground	24	SA+(22)	37	BALE
11	SD+(14)	25	SA+(1)	38	IOR-
12	SD+(15)	26	Ground	39	D7BUFDIR
13	SD+(11)	27	SA+(3)	40	PWR_DWN
14	SD+(10)				

J33, MCBL084A, PCMCIA ISA Bus

Pin	Signal	Pin	Signal	Pin	Signal
1	Spare	15	SD+(2)	28	Ground
2	IRQ11	16	SD+(3)	29	SA+(4)
3	IRQ4	17	SD+(6)	30	SA+(5)
4	IRQ5	18	SD+(7)	31	SA+(8)
5	0WS-	19	SA+(19)	32	SA+(9)
6	Ground	20	SA+(20)	33	SA+(12)
7	MEMCS16-	21	SA+(23)	34	SA+(13)
8	Ground	22	SBHE-	35	SA+(16)
9	SPKR-	23	SA+(0)	36	AEN
10	Ground	24	Ground	37	IOW-
11	SD+(13)	25	SA+(2)	38	Ground
12	SD+(12)	26	Ground	39	LOBUFDIR
13	SD+(9)	27	ISA BCLK	40	HIBUFDIR
14	SD+(8)				

Sound Controller

The sound controller is the Vibra 16C chip from Creative Labs. Integrated onto the system board, the controller is a complete, full-featured MPC 2.0 compliant sound implementation, providing full Sound Blaster Pro functionality and compatibility. The sound controller has the following features and specifications:

Feature	Specification
Sound Controller	Creative Labs Vibra 16C
Audio Resolution	16-bit
Sound Blaster Compatibility	Sound Blaster Pro, with Sound Blaster 16 register compatibility
MIDI/UART Mode/ Compatibility	Roland MPU401
Bus Interface	16-bit ISA
CODEC	16-bit Sigma Delta Stereo
CODEC FIFO	4 Samples
FM Synthesizer	Yamaha OPL3
External Audio Inputs	Microphone (Monaural), Stereo Line-In
Internal Audio Inputs	Stereo FM Synthesis, Stereo Wave Data, Stereo CD, Monaural PC Speaker
Audio Outputs	Stereo Line-Out
MIDI/Joystick	MIDI In, MIDI Out, up to 4 fire buttons
ADPCM Audio Compression	4:1, 3:1, and 2:1
Sampling Rate Range	5 KHz - 44.1 KHz in 228 selectable steps
Selectable Microphone AGC	Yes
Microphone Support	Low-Impedance (600 Ohms) Dynamic, Electek

The Vibra 16C sound controller is configured entirely through I/O port accesses. When the system is powered up, the hardware forces the Vibra 16C to respond to default I/O port addresses, interrupt request (IRQ) level, and direct memory access (DMA) request and acknowledge. The following table shows the default sound controller configurations and available programmable settings.

Parameter	Default	Other Available
Base I/O Address / MPU-401	220/330	240/300
8-bit DMA Req / Ack Level	1	3
16-bit DMA Req / Ack Level	5	7
Interrupt Request Level	10	5, 7

The settings above may be changed in AMIBIOS Setup (see “Chipset Setup” in the Setup and Maintenance Guide, delivered with the system) so the Vibra 16C internal registers respond to custom settings.

Address Resources for MSMT353 and MSMT359

DMA Channels

The system board uses Direct Memory Address (DMA) channels to exchange data without accessing the CPU. Some channels are assigned for specific use by the system, as defined below. Each DMA channel or MSMT359 appropriates full 32-bit processing. For an ISA bus, channels 0 through 3 are 8-bit and channels 4 through 7 are 16-bit channels.

DMA	Assignment	DMA	Assignment
0	Spare	4	Cascade input for 0-3
1	Vibra 16C Controller	5	Vibra 16C Controller
2	I/O Controller	6	Spare
3	Parallel Port	7	Spare

Input/Output Addresses

The following table lists a small subset of the reserved I/O or MSMT359 addresses.

Address	Device
0278 - 027F	Parallel Port LPT2
02E8 - 02EF	Serial Port COM4
02F8 - 02FF	Serial Port COM2
0378 - 037F	Parallel Port LPT1
03B0 - 03BF	Monochrome Display/Printer Adapter
03C0 - 03CF	Enhanced Graphics Adapter (EGA/VGA)
03D0 - 03DF	Color/Graphics Monitor Adapter (CGA/MCGA)
03E8 - 03EF	Serial Port COM3
03F0 - 03F7	I/O Controller
03F8 - 03FF	Serial Port COM1

Memory Address Map

The following table lists the memory address map or MSMT359 assignments.

Memory Address	Size	Assignment
00000000 - 0009FFFF	640K	System board memory
000A0000 - 000BFFFF	128K	Video memory
000C0000 - 000C7FFF	32K	Video ROM
000C8000 - 000DFFFF	96K	Available I/O Adapter ROM
000E0000 - 000EFFFF	64K	BIOS ROM and PCMCIA
000F0000 - 000FFFFF	64K	BIOS ROM
00100000 - 0FFFFFFF	256M	Expansion memory
10000000 - 3FFFFFFF	-----	Reserved

PCI to ISA Bus Interrupt Mapping

The ISA bridge (Intel 82379AB) or MSMT359 the sixteen conventional ISA interrupts, plus four interrupt request pins for PCI peripheral interrupts (PIRQ0 through PIRQ3). For PC-AT architecture compatibility reasons, the PCI interrupts are routed to the ISA interrupts within the ISA bridge. The assertion of a PCI interrupt concludes in an ISA interrupt being asserted.

The 8-bit PIRQ Route Control Registers in the ISA bridge determine to which ISA interrupt a PIRQ or MSMT359 is routed. Four PIRQ Route Control Registers are used for the PCI interrupts, located at the ISA bridge address offsets defined below.

PCI Interrupt Request	Address Offset (Hex)
PIRQ0	60
PIRQ1	61
PIRQ2	62
PIRQ3	63

Bit 7 of each PIRQ registers enable (Low) or disable (High) the routing of the PIRQ to an ISA interrupt. The lowest four bits (3:0) of each PIRQ register determines to which ISA interrupt the PIRQ will be routed, as defined below.

Bits (3:0) of PIRQ	ISA Interrupt	Bits (3:0) of PIRQ	ISA Interrupt
0000	Reserved	1000	Reserved
0001	Reserved	1001	IRQ9
0010	Reserved	1010	IRQ10
0011	IRQ3	1011	IRQ11
0100	IRQ4	1100	IRQ12
0101	IRQ5	1101	Reserved
0110	IRQ6	1110	IRQ14
0111	IRQ7	1111	IRQ15

PCI Bus Configuration Space

The table below lists the configuration space used for the primary PCI bus. The PCI bus uses type 1 configuration access, which specifies two 32-bit I/O ports used as the index register (0CF8h) and the data register (0CFCh).

Device	Device Number	0CF8h Value
Host-to-PCI Bridge (PCMC)	0	800000XX
PCI-to-ISA Bridge	2	800010XX
Graphics Accelerator	5	800028XX
Ethernet Controller	6	800030XX
SCSI Controller	7	800038XX
PCI Slot 1	D	800068XX
PCI Slot 2	E	800070XX
PCI Slot 3	F	800078XX

Each PCI slot on the riser card has four available or MSMT359 interrupt lines: INTA, INTB, INTC, and INTD. These are connected to the PCI interrupts, PIRQ0 through PIRQ3, as shown below:

Interrupt Line	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6
INTA	PIRQ0	PIRQ1	PIRQ2	PIRQ3	PIRQ0	PIRQ1
INTB	PIRQ1	PIRQ2	PIRQ3	PIRQ0	PIRQ1	PIRQ2
INTC	PIRQ2	PIRQ3	PIRQ0	PIRQ1	PIRQ2	PIRQ3
INTD	PIRQ3	PIRQ0	PIRQ1	PIRQ2	PIRQ3	PIRQ0

ISA Bus

The ISA slots on the riser card MSMT463 accommodate ISA based option boards and a 16-bit wide expansion bus. The ISA bus or MSMT359 interrupt (IRQ) assignments are defined below.

IRQ	Name	IRQ	Name
0	System Timer 0	8	Real Time Clock
1	Keyboard Full	9	Spare
2	Cascade input for IRQ8 - IRQ15	10	Vibra 16C Controller
3	COM2, COM4	11	Spare
4	COM1, COM3	12	Mouse
5	Spare	13	Not Available
6	I/O Controller	14	Spare
7	Parallel Port	15	Spare

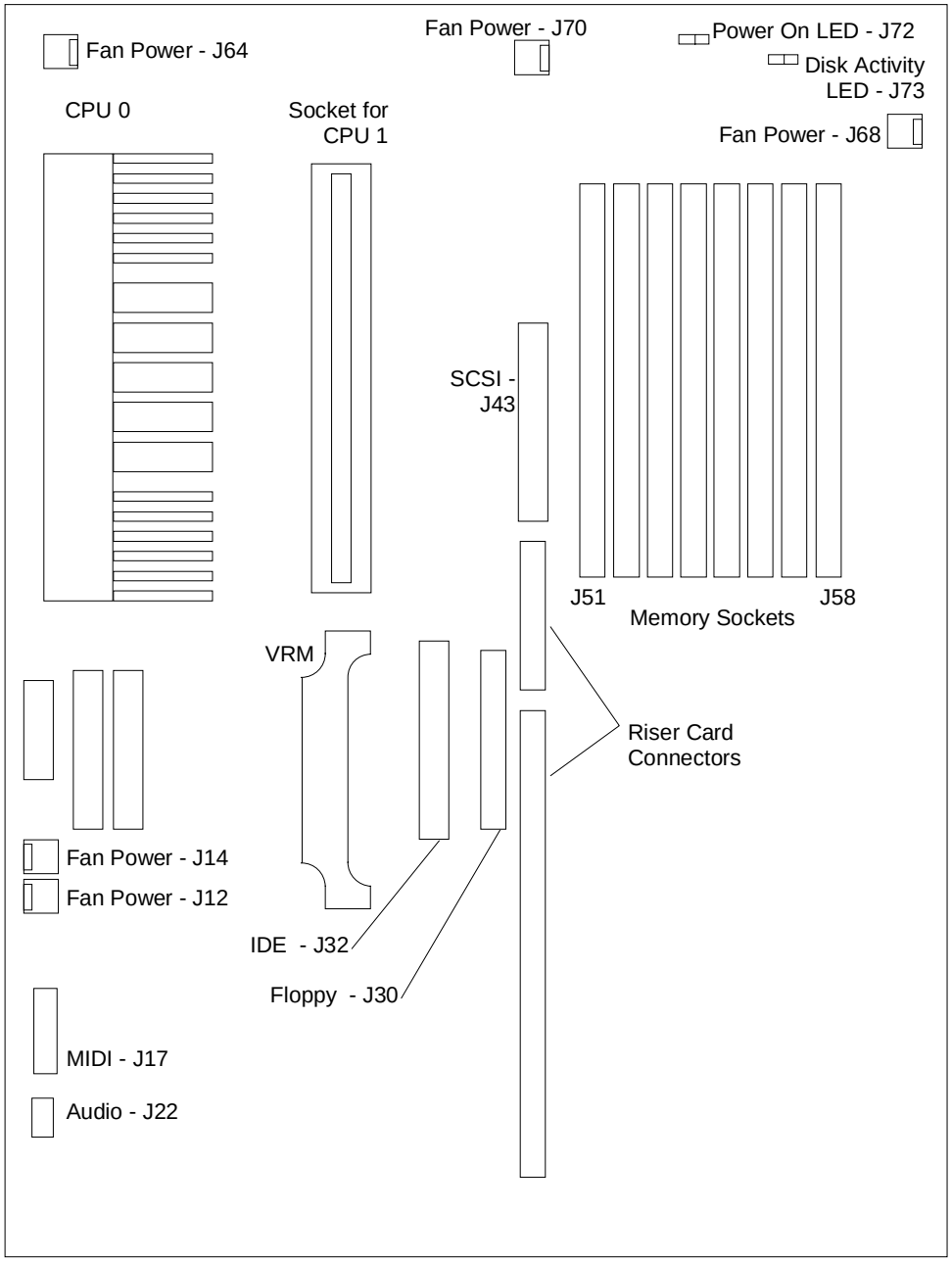
The spare interrupts listed above may be assigned to PCI and ISA devices. When you add a PCI device to the system, the interrupt will be automatically assigned by the system BIOS. However, at least one interrupt must be available for the PCI bus. For increased performance, one interrupt should be left available for each PCI based controller used in the system. When you add a ISA board, you must assign the interrupt using the System Configuration Utility and jumpers on the option board.

6 System Board MSMT378

This chapter provides information about board connectors, the sound controller, and address resources for the MSMT378 system board, which uses Pentium II processors. Refer to “Board Combinations” in Chapter 4 for details on board types used in the various workstations and servers.

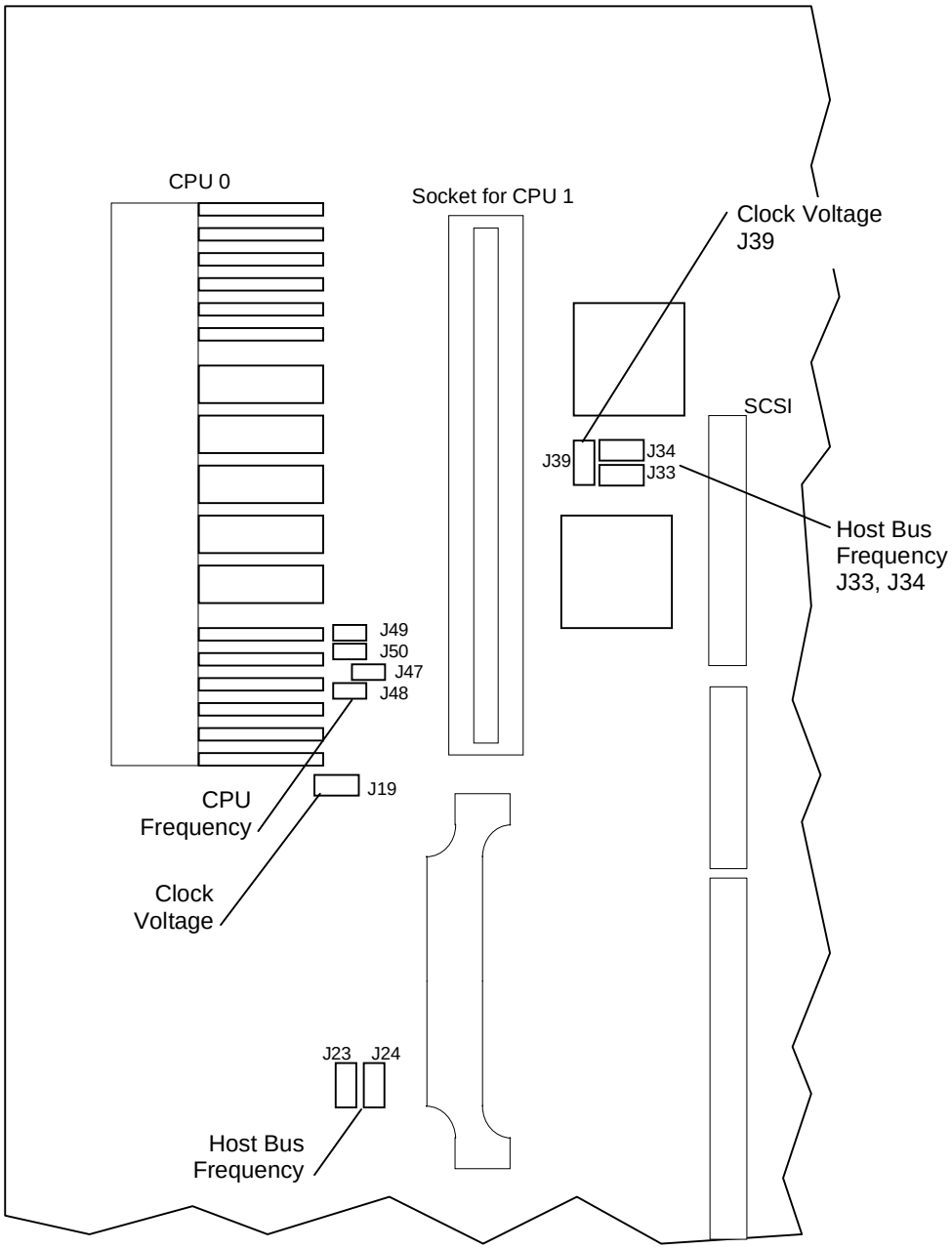
Connectors

The following figure shows the internal connector locations.



Jumpers

The system board uses jumpers to set the CPU frequency and clock voltage.



CPU Frequency and Host Bus Frequency

The following table shows the jumper settings for the CPU frequency and its corresponding host bus frequency. IN denotes the jumper is installed on both pins.

CPU Frequency Jumper	200 MHz	233 MHz	266 MHz	300 MHz
J48	OUT	OUT	IN	IN
J47	IN	IN	OUT	OUT
J50	IN	OUT	IN	OUT
J49	IN	IN	IN	IN
Host Bus Frequency Jumper	**66 MHz**	**66 MHz**	**66 MHz**	**60 MHz**
J23				IN
J24	IN	IN	IN	
J33	IN	IN	IN	
J34				IN

CPU Voltage

The 200 MHz CPU uses a clock voltage of 3.3 volts, and the 266 MHz and 300 MHz CPU use a clock voltage of 2.5 volts.

WARNING **Double-check voltage jumper settings before starting the system! Setting a high voltage for a 266 MHz or 300 MHz processor will destroy the processor.**

The following table shows voltage jumper settings. IN denotes the jumper is installed on both pins.

Jumper	200 MHz/3.3v	266 MHz/2.5v	300 MHz/2.5v
J19	IN	OUT	OUT
J39	OUT	IN	IN

BIOS Password Clear

J16 on the system board (near the parallel port) enables or disables the BIOS password stored in CMOS RAM. By default, the jumper is not installed, and the password (if present) is enabled. If the jumper is installed, the password is cleared, allowing the AMIBIOS Setup program to be accessed without entering a password. You may need to remove the PCI option boards (if installed) to access J16.

Cable Routing and Pinouts

From	Cable	To
J12, Fan Power	MCBLZ660	Internal bay disk drive fan
J17, MIDI	MCBL038A	External MIDI port
J22, Audio	MCBLZ630	SCSI CD-ROM drive
J22, Audio	MCBL122A	EIDE CD-ROM drive
J30, Floppy	MCBLZ380	Floppy disk drive
J32, Primary EIDE	MCBL121	EIDE CD-ROM drive

From	Cable	To
J43, SCSI	MCBL176A	External SCSI drives
J68, Fan Power	MCBLZ177	System Fans
J64, Fan Power	MCBLZ660	Vertical bay disk drive fan
J72, Power On LED	MCBLZ610	Power On LED
J73, Disk Activity LED	MCBLZ620	Disk Activity LED

J17, MCBL038A, MIDI

Pin	Signal	Pin	Signal	Pin	Signal
1	+5V	6	Y-axis, joystick 1	11	X-axis, joystick 2
2	Fire button 0	7	Fire button 1	12	MIDI out
3	X-axis, joystick 1	8	+5V	13	Y-axis, joystick 2
4	Ground	9	+5V	14	Fire button 3
5	Ground	10	Fire button 2	15	MIDI in

J22, MCBLZ630 (for SCSI drive) or MCBL122A (for EIDE drive), Audio

Pin	Signal
1	Right Sound Channel
2	Ground
3	Left Sound Channel
4	Ground

J30, MCBLZ380, Floppy

Pin	Signal	Pin	Signal	Pin	Signal
2	RPM	14	DRV0-	26	TRK0-
4	No connect	16	MTR1-	28	WRPRT-
6	DRATE0	18	DIR	30	RDATA-
8	INDEX-	20	STEP-	32	HDSEL
10	MTR0-	22	WDATA-	34	DSKCHG
12	DRV1-	24	WGATE-		

NOTE All odd-numbered pins of J30 are connected to ground, except pin 29 (MID1) and pin 33 (MID0).

J43, MCBL176A, SCSI

Pin	Signal	Pin	Signal	Pin	Signal
26	CD0	33	CD7	46	MSG
27	CD1	34	CD Parity	47	SCT
28	CD2	38	TPWR	48	CMD
29	CD3	41	ATTN	49	REQ
30	CD4	43	BSY	50	I/O
31	CD5	44	ACK	Remaining	Ground
32	CD6	45	RST		

J68, MCBLZ177, Fan power

Pin	Signal	Color
1	+12V	Red
2	Ground	Black

J12 and J64, MCBLZ660, Fan power

Pin	Signal	Color
1	+12V	Red
2	Ground	Black

J72, MCBLZ610, Power On LED

Pin	Signal	Wire Color
1	Pwrgood	Red
2	Ground	Black

J73, MCBLZ620, Disk Activity LED

Pin	Signal	Wire Color
1	DiskActive	Orange
2	Ground	Black

J32, MCBL121, Primary EIDE Bus

Pin	Signal	Pin	Signal	Pin	Signal
1	BRSTDRV-	15	D01+(1)	28	VCC
2	Ground	16	D01+(14)	29	DOAK0-
3	D01+(7)	17	D01+(0)	30	Ground
4	D01+(8)	18	D01+(15)	31	IRQ14
5	D01+(6)	19	Ground	32	IOCS6-
6	D01+(9)	20	-------	33	DA1
7	D01+(5)	21	D0RQ0-	34	-------
8	D01+(10)	22	Ground	35	DA0

Pin	Signal	Pin	Signal	Pin	Signal
9	D01+(4)	23	DOIOW-	36	DA2
10	D01+(11)	24	Ground	37	CS1P-
11	D01+(3)	25	D0IOR-	38	CS3P-
12	D01+(12)	26	Ground	39	IDEACTVP-
13	D01+(2)	27	IORDY	40	Ground
14	D01+(13)				

Sound Controller

The sound controller is the Crystal CS4236B from Crystal Labs. Integrated onto the system board, the controller is a complete, full-featured PC 97 compliant sound implementation. The sound controller has the following features and specifications:

Feature	Specification
Sound Controller	Crystal Labs CS4236B
Audio Resolution	16-bit
Sound Blaster Compatibility	PC 97
MIDI/UART Mode/Compatibility	Roland MPU401
Bus Interface	16-bit ISA
CODEC	Delta Sigma-based Windows Sound System
CODEC FIFO	16 Samples
FM Synthesizer	Crystal internal FM synthesis
External Audio Inputs	Microphone (Monaural), Stereo Line-In
Internal Audio Inputs	Stereo FM Synthesis, Stereo Wave Data, Stereo CD, Monaural PC Speaker
Audio Outputs	Stereo Line-Out
MIDI/Joystick	MIDI In, MIDI Out, up to 4 fire buttons
ADPCM Audio Compression	4:1, 3:1, and 2:1
Sampling Rate Range	5 KHz - 44.1 KHz in 228 selectable steps

The Crystal CS4236B sound controller is configured entirely through I/O port accesses. When the system is powered up, the hardware forces the Crystal CS4236B to respond to default I/O port addresses, interrupt request (IRQ) level, and direct memory access (DMA) request and acknowledge. The following table shows the default sound controller configurations and available programmable settings.

Parameter	Default
Base I/O Address / MPU-401	220/330
8-bit Playback DMA	1
8-bit Capture DMA	3
Base IRQ / MPU IRQ	5/15

Address Resources

DMA Channels

The system board uses Direct Memory Address (DMA) channels to exchange data without accessing the CPU. Some channels are assigned for specific use by the system, as defined below. Each DMA channel appropriates full 32-bit processing. For an ISA bus, channels 0 through 3 are 8-bit and channels 4 through 7 are 16-bit channels.

DMA	Assignment	DMA	Assignment
0	LPT	4	Cascade input for 0-3
1	Crystal CS4236B Controller	5	Spare
2	Floppy Controller	6	Spare
3	Crystal CS4236B Controller	7	Spare

Input/Output Addresses

The following table lists a small subset of the reserved I/O addresses.

Address	Device
0278 - 027F	Parallel Port LPT2
02E8 - 02EF	Serial Port COM4
02F8 - 02FF	Serial Port COM2
0378 - 037F	Parallel Port LPT1
03B0 - 03BF	Monochrome Display/Printer Adapter
03C0 - 03CF	Enhanced Graphics Adapter (EGA/VGA)
03D0 - 03DF	Color/Graphics Monitor Adapter (CGA/MCGA)
03E8 - 03EF	Serial Port COM3
03F0 - 03F7	I/O Controller
03F8 - 03FF	Serial Port COM1

Memory Address Map

The following table lists the memory address map assignments.

Memory Address	Size	Assignment
00000000 - 0009FFFF	640K	System board memory
000A0000 - 000BFFFF	128K	Video memory
000C0000 - 000C7FFF	32K	Video ROM
000C8000 - 000DFFFF	96K	Available I/O Adapter ROM
000E0000 - 000EFFFF	64K	BIOS ROM and PCMCIA
000F0000 - 000FFFFF	64K	BIOS ROM
00100000 - 1FFFFFFF	511M	Expansion memory
20000000 - 3FFFFFFF	-----	Reserved

PCI to ISA Bus Interrupt Mapping

The ISA bridge (Intel 82371SB) provides the sixteen conventional ISA interrupts, plus four interrupt request pins for PCI peripheral interrupts (PIRQ0 through PIRQ3). For PC-AT architecture compatibility reasons, the PCI interrupts are routed to the ISA interrupts within the ISA bridge. The assertion of a PCI interrupt concludes in an ISA interrupt being asserted.

Bit 7 of each PIRQ registers enable (Low) or disable (High) the routing of the PIRQ to an ISA interrupt. The lowest four bits (3:0) of each PIRQ register determines to which ISA interrupt the PIRQ will be routed. The PIRQs can be mapped to the following ISA interrupts: IRQ 5, 9, 10, 11, and 15.

Each PCI slot on the riser card has four available interrupt lines: INTA, INTB, INTC, and INTD. These are connected to the PCI interrupts, PIRQ0 through PIRQ3, as shown below:

Interrupt Line	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6
INTA	PIRQ0	PIRQ1	PIRQ2	PIRQ3	PIRQ0	PIRQ1
INTB	PIRQ1	PIRQ2	PIRQ3	PIRQ0	PIRQ1	PIRQ2
INTC	PIRQ2	PIRQ3	PIRQ0	PIRQ1	PIRQ2	PIRQ3
INTD	PIRQ3	PIRQ0	PIRQ1	PIRQ2	PIRQ3	PIRQ0

ISA Bus

The ISA slots on the MSMT463 riser card accommodate ISA based option boards and a 16-bit wide expansion bus. The ISA bus interrupt (IRQ) assignments are defined below.

IRQ	Name	IRQ	Name
0	System Timer	8	Real Time Clock
1	Keyboard	9	H/W Monitor
2	Cascade input for IRQ8 - IRQ15	10	Spare
3	COM2, COM4	11	Spare
4	COM1, COM3	12	Mouse
5	Crystal CS4236B Controller	13	Floating Point Unit
6	Floppy Controller	14	EIDE CDROM
7	Parallel Port	15	MIDI Port

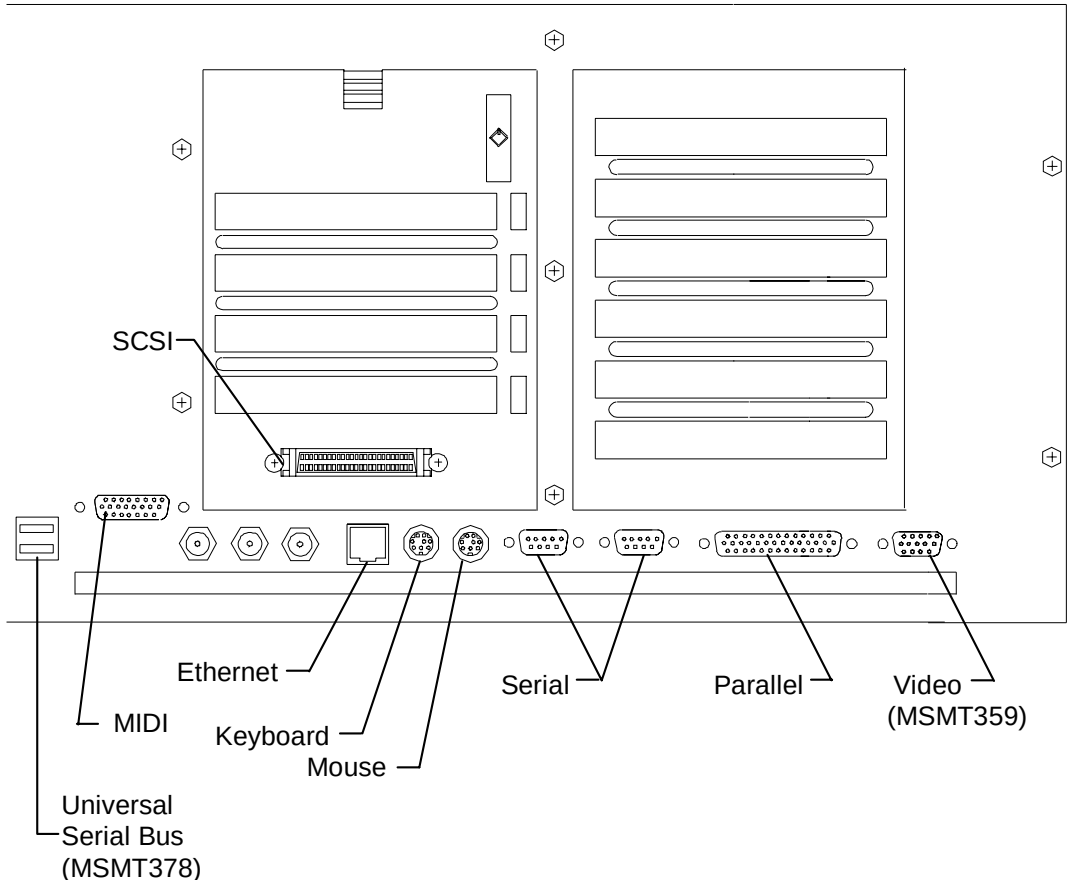
The spare interrupts listed above may be assigned to PCI and ISA devices. When you add a PCI device to the system, the interrupt will be automatically assigned by the system BIOS. However, at least one interrupt must be available for the PCI bus. For increased performance, one interrupt should be left available for each PCI based controller used in the system. When you add a ISA board, you must assign the interrupt using the System Configuration Utility and jumpers on the option board.

The Sound Controller can be configured for either IRQs 5, 7, 9, 11, 12, or 15. The MIDI Port can be configured for either IRQs 9, 10, 11, 15, or no interrupt, in which case it will act as a write-only device.

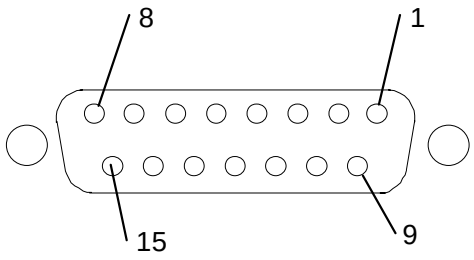
7 External Port Pinouts

This chapter describes the external port pinouts for the MSMT353 or MSMT359 and MSMT378 system boards. The pinouts are the same for both systems, except where noted.

The following figure shows the external ports on the back of the base unit.

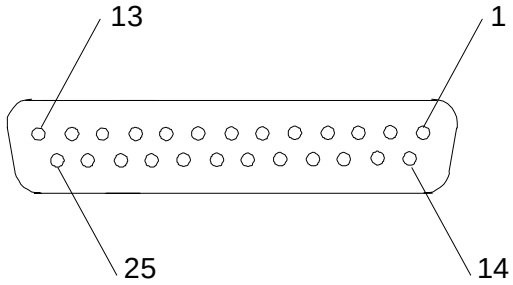


MIDI/Game



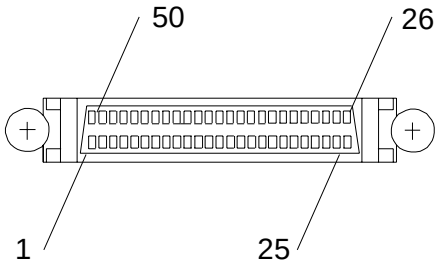
Signal	Pin	Signal	Pin
+5V	1	+5V	9
Fire button 0	2	Fire button 2	10
X-axis, joystick 1	3	X-axis, joystick 2	11
Ground	4	MIDI out	12
Ground	5	Y-axis, joystick 2	13
Y-axis, joystick 1	6	Fire button 3	14
Fire button 1	7	MIDI in	15
+5V	8		

Parallel



Signal	Pin	Signal	Pin
Strobe	1	ACK - Acknowledge	10
Data 0	2	Busy	11
Data 1	3	PE - Paper Empty	12
Data 2	4	+Select	13
Data 3	5	Auto FDXT - Auto Feed	14
Data 4	6	Error	15
Data 5	7	Init - Start	16
Data 6	8	SLCTIN - Select	17
Data 7	9	Ground	18-25

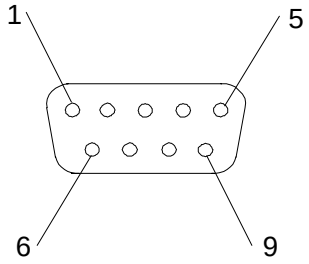
SCSI



Signal	Pin	Signal	Pin
Command Data-0	26	Attention	41
Command Data-1	27	Busy	43
Command Data-2	28	Acknowledge	44
Command Data-3	29	Reset	45
Command Data-4	30	Message	46
Command Data-5	31	Select	47
Command Data-6	32	Command	48
Command Data-7	33	Request	49
Command Data Parity	34	Input/Output	50
Terminator Power	38		

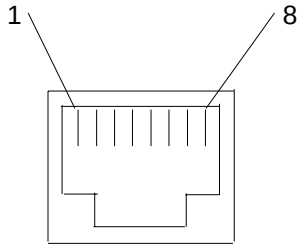
NOTE Pins 12, 13, 14, 37, and 39 are not connected; all other pins not listed are connected to ground.

Serial (COM)



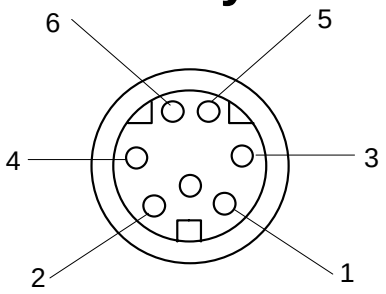
Signal	Pin
DCD - Data Carrier Detect	1
RD - Receive Data	2
TD - Transmit Data	3
DTR - Data Terminal Ready	4
Ground	5
DSR - Data Set Ready	6
RTS - Request to Send	7
CTS - Clear to Send	8
RI - Ring Indicator	9

Ethernet 10/100 Base-TX



Signal	Pin
TD+ - Transmit Data	1
TD– - Transmit Data	2
RD+ - Receive Data	3
Reserved	4
Reserved	5
RD– - Receive Data	6
Reserved	7
Reserved	8

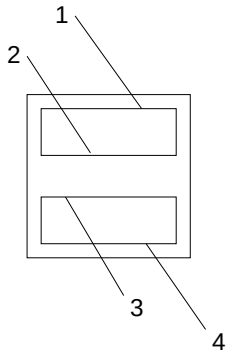
Mouse and Keyboard



Mouse Signal	Pin
MDATA - Mouse Data	1
Reserved	2
Ground	3
Fused VCC - +5V	4
MCLK - Mouse Clock	5
Reserved	6

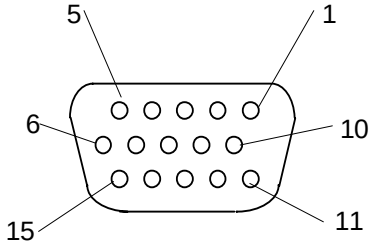
Keyboard Signal	Pin
KDATA - Keyboard Data	1
Reserved	2
Ground	3
Fused VCC - +5V	4
KCLK - Keyboard Clock	5
Reserved	6

Universal Serial Bus (for MSMT378 system board)



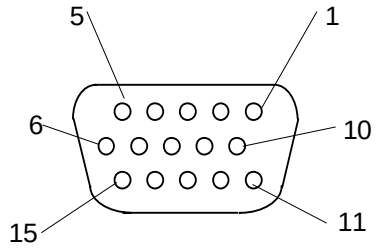
Signal	Contact
VCC (Cable Power)	1
Negative Data	2
Positive Data	3
Ground	4

Video (for MSMT353 or MSMT359 system board)



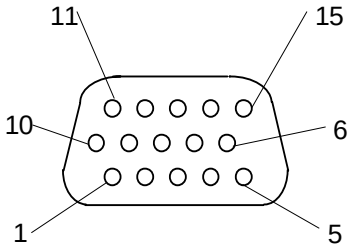
Z10 Signal	G95/I3D/Z13/Z25 Signal	Pin
R - Red	R - Red	1
G - Green	G - Green	2
B - Blue	B - Blue	3
Ground	MID2 - Monitor ID2	4
Ground	Ground	5
Ground	Ground	6
Ground	Ground	7
Ground	Ground	8
No Connect	Supply +5V (No Connect on G95)	9
Ground	Ground	10
Ground	MID0 - Monitor ID0	11
Ground	MID1 - Monitor ID1	12
HSYNC - Horizontal Sync	HSYNC - Horizontal Sync	13
VSYNC - Vertical Sync	VSYNC - Vertical Sync	14
Ground	MID3 - Monitor ID3	15

VGA In (for MSMT353 or MSMT359 system board)



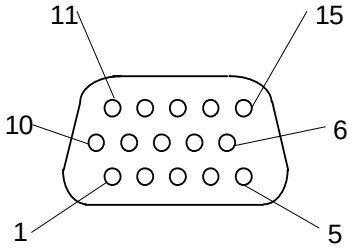
Z10 Signal	I3D/Z13/Z25 Signal	Pin
R - Red	R - Red	1
G - Green	G - Green	2
B - Blue	B - Blue	3
Ground	MID2 - Monitor ID2	4
Ground	Cable Sense	5
Ground	Ground	6
Ground	Ground	7
Ground	Ground	8
No Connect	No Connect	9
Ground	Ground	10
Ground	MID0 - Monitor ID0	11
Ground	MID1 - Monitor ID1	12
HSYNC - Horizontal Sync	HSYNC - Horizontal Sync	13
VSYNC - Vertical Sync	VSYNC - Vertical Sync	14
Ground	MID3 - Monitor ID3	15

Video Out (for MSMT378 system board)



G95/I3D/Z13/Z25/V25 Signal	Pin	G95/I3D/Z13/Z25/V25 Signal	Pin
R - Red	1	Ground	8
G - Green	2	Supply +5V (No Connect on G95)	9
B - Blue	3	Ground	10
MID2 - Monitor ID2	4	MID0 - Monitor ID0	11
Ground	5	MID1 - Monitor ID1	12
Ground	6	HSYNC - Horizontal Sync	13
Ground	7	VSYNC - Vertical Sync	14
		MID3 - Monitor ID3	15

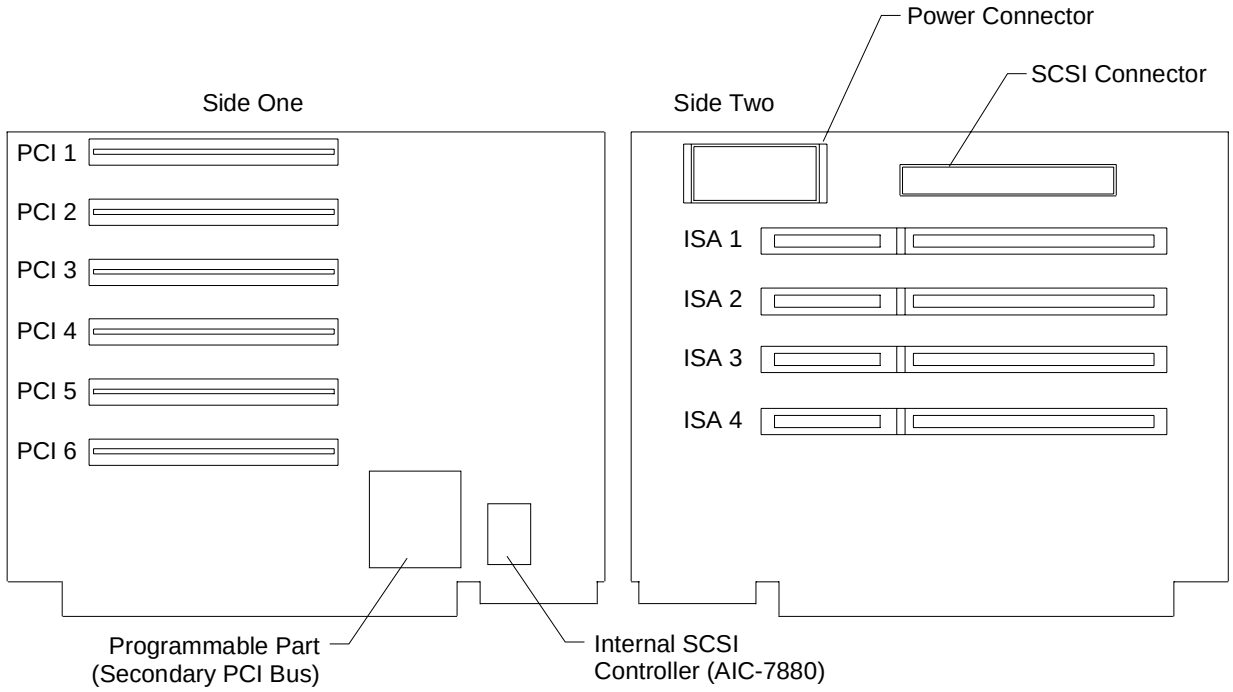
VGA In (for MSMT378 system board)



I3D/Z13/Z25/V25 Signal	Pin	I3D/Z13/Z25/V25 Signal	Pin
R - Red	1	Ground	8
G - Green	2	No Connect	9
B - Blue	3	Ground	10
MID2 - Monitor ID2	4	MID0 - Monitor ID0	11
Cable Sense	5	MID1 - Monitor ID1	12
Ground	6	HSYNC - Horizontal Sync	13
Ground	7	VSYNC - Vertical Sync	14
		MID3 - Monitor ID3	15

8 Riser Card MSMT463

This chapter describes the components on the riser card MSMT463 and the graphics card configurations. The following figure shows the riser card.



Expansion Slots

The riser card has six PCI slots and four ISA slots. PCI slots 5 and 6 are on the primary PCI bus, supported by the PCI bridge on the system board. PCI slots 1 through 4 (secondary) are supported by an Intergraph programmable part on the riser card. Some PCI option boards must be installed in a primary PCI slot, as stated in the documentation delivered with the option board.

Systems with the MSMT359 system board have onboard G95 video. Other systems that do not use onboard G95, such as RenderRAX, use the G95 card (MSMT340) in PCI slot 5, or other graphics board in specified slots (see below).

NOTE Full-length PCI cards cannot be installed in PCI slot 6 if the processor module is installed on system board MSMT353. The processor module is used in quad-processor systems only.

Internal SCSI Controller

The system's internal SCSI controller is the Adaptec AIC-7880. All internal SCSI devices use the AIC-7880.

SCSI Connector

The SCSI connector is on side 2 of the riser card. The cable MCBL234A connects to the SCSI connector and to the internal SCSI devices. The following shows the cable pinout. Pins not listed in the table are connected to Ground.

Pin	Signal	Pin	Signal
26	Command Data-0	41	Attention
27	Command Data-1	43	Busy
28	Command Data-2	44	Acknowledge
29	Command Data-3	45	Reset
30	Command Data-4	46	Message
31	Command Data-5	47	Select
32	Command Data-6	48	Command
33	Command Data-7	49	Request
34	Command Data Parity	50	Input/Output
38	Terminator Power		

Power Connector

The power supply cable P1 connects to the power connector.

Graphics Option Card Slot Assignments

Graphics cards are installed in specific PCI slots on the riser card. The following chart specifies the slots where graphics boards are located.

NOTE Systems with onboard graphics use G95 accelerator on the system board, rather than an installed PCI card.

	G95	G95, Dual Screen (DS)
Slot 4		G95 card (first screen)
Slot 5	G95 card	G95 card (second screen)

	Intense 3D 1000 (I3D)	I3D, DS	I3D with Geometry (G)	I3D-G, DS
Slot 3		I3D card		I3D card
Slot 4	I3D card	I3D card	I3D card	I3D card
Slot 5			Geometry accelerator	Geometry accelerator

	Z13	Z13, DS	Z13-G	Z13-G, DS
Slot 1		Z13 card		Z13 card
Slot 2		VGA card		VGA card
Slot 3	Z13 card	Z13 card	Z13 card	Z13 card
Slot 4	VGA card	VGA card	VGA card	VGA card

Slot 5			Geometry accelerator	Geometry accelerator

	Z25	**Z25 Dual Screen**	**Z25-G**	**Z25-G Dual Screen**
Slot 1		Z25 card		Z25 card
Slot 2		VGA card		VGA card
Slot 3	Z25 card	Z25 card	Z25 card	Z25 card
Slot 4	VGA card	VGA card	VGA card	VGA card
Slot 5			Geometry accelerator	Geometry accelerator

	V25	**V25 Dual Screen**	**V25-G**	**V25-G Dual Screen**
Slot 1		V25 card		V25 card
Slot 2		VGA card		VGA card
Slot 3	V25 card	V25 card	V25 card	V25 card
Slot 4	VGA card	VGA card	VGA card	VGA card
Slot 5			Geometry accelerator	Geometry accelerator

9 Peripherals

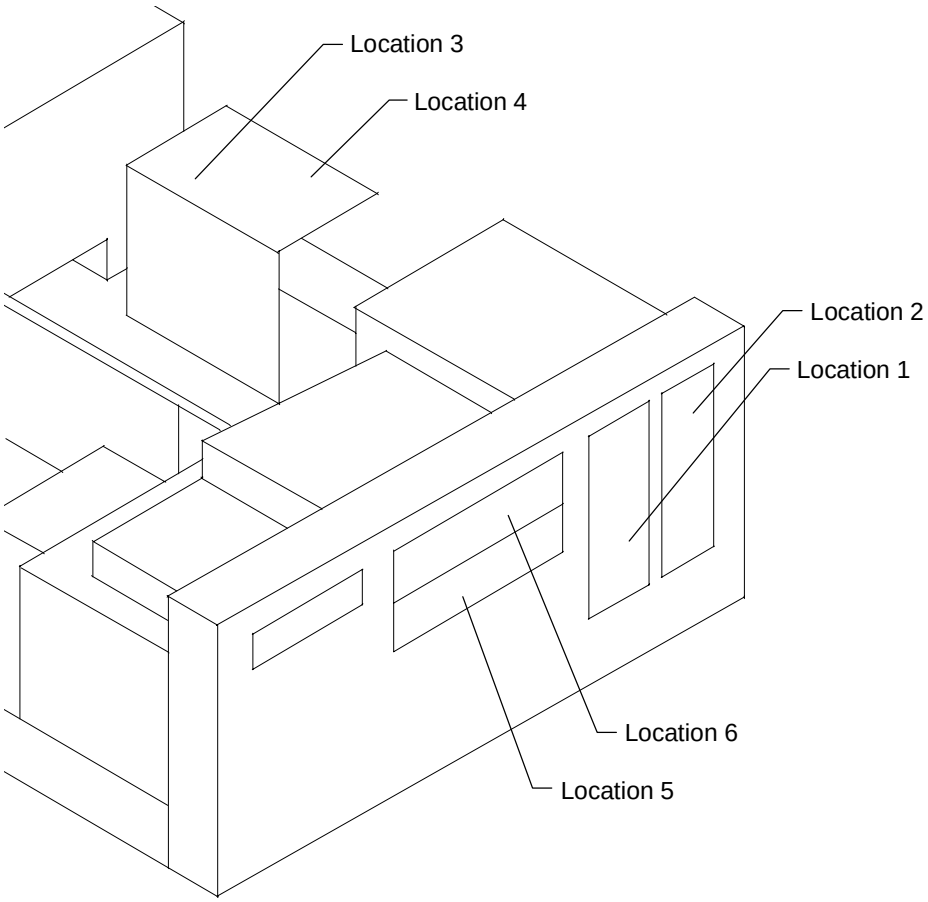
This chapter provides information on configuring peripherals in all rack-mount systems.

Up to six SCSI devices may be added to the system drive bays. The following table defines the standard drive locations when drives are factory installed.

Location	Drive	SCSI ID
1 - Left Vertical	System disk drive	0
2 - Right Vertical	Add-on disk drive	1
3 - Left Internal	Add-on disk drive	2
4 - Right Internal	Add-on disk drive	3
5 - Lower Horizontal	CD-ROM drive	4
6 - Upper Horizontal	Other drive type	5 or 6

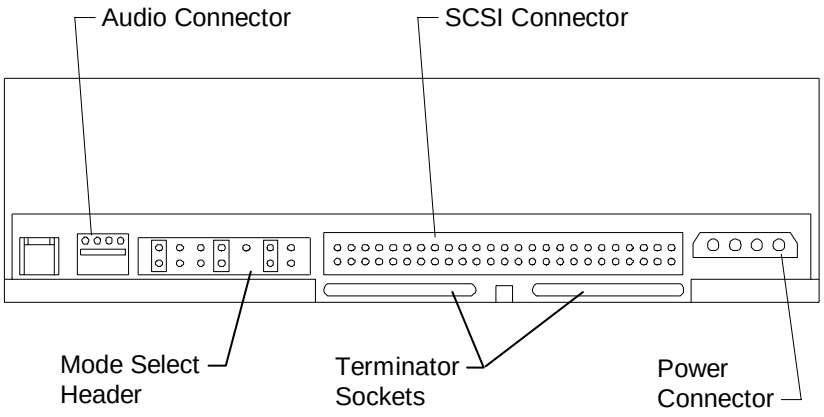
NOTE The SCSI cable MCBL234A provides active termination. All SCSI devices installed in the system must have termination disabled.

The following figure shows the physical drive locations in the system.



SCSI CD-ROM Drive (CDSK178)

The following figure shows the back of the CD-ROM drive.



- The audio connector uses MCBLZ630 and connects to J22 on the system board. Refer to Chapter 5 or 6 for the cable pinout.
- The SCSI connector uses MCBL234A and connects to the riser card.
- Settings for mode select header, which sets SCSI ID, parity, and other drive functionality are printed on the CD-ROM drive.
- Terminator resistors are installed in the terminator sockets only when active termination is required. By default, these sockets are empty since termination is provided by the SCSI cable.
- The power connector uses power supply cable P6 from the power supply. Refer to Chapter 10, “Power Supply and Fans,” for the cable pinout.

Disk Drives

Any of the following disk drives can be used in the system.

Part Number	Vendor Number	Capacity
CDSK098	Conner CFP4207S	4 GB
CDSK111	Seagate ST51080N	1 GB
CDSK094	Seagate ST32155N	2 GB
CDSK123	Seagate ST34371N	4 GB
CDSK164	Seagate ST34501N	4 GB
CDSK167	Seagate ST34501W	4 GB
CDSK165	Seagate ST19101N	9 GB
CDSK166	Seagate ST19101W	9 GB

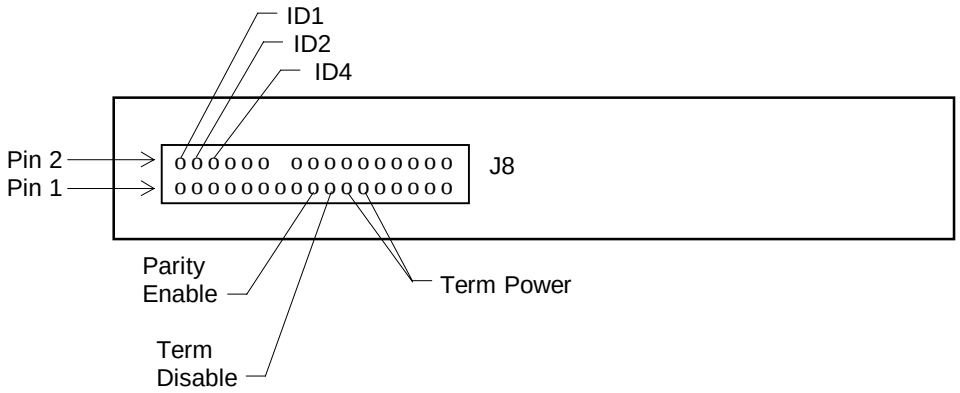
SCSI ID selection is defined in the following table. Each disk drive has a connector which uses jumpers to set the SCSI ID. Where Seagate uses ID1, ID2, and ID4 to identify how to set the SCSI ID, Conner uses 0E1, 0E2, and 0E3.

SCSI ID	ID1/0E1	ID2/0E2	ID4/0E3
0	Off	Off	Off
1	On	Off	Off
2	Off	On	Off
3	On	On	Off
4	Off	Off	On
5	On	Off	On
6	Off	On	On

- The SCSI connector uses MCBL234A and connects to the riser card.
- The power connector uses any of the P2 through P7 power supply cables from the power supply. Refer to Chapter 10, “Power Supply and Fans” for the cable pinout.

CDSK111 (1 GB)

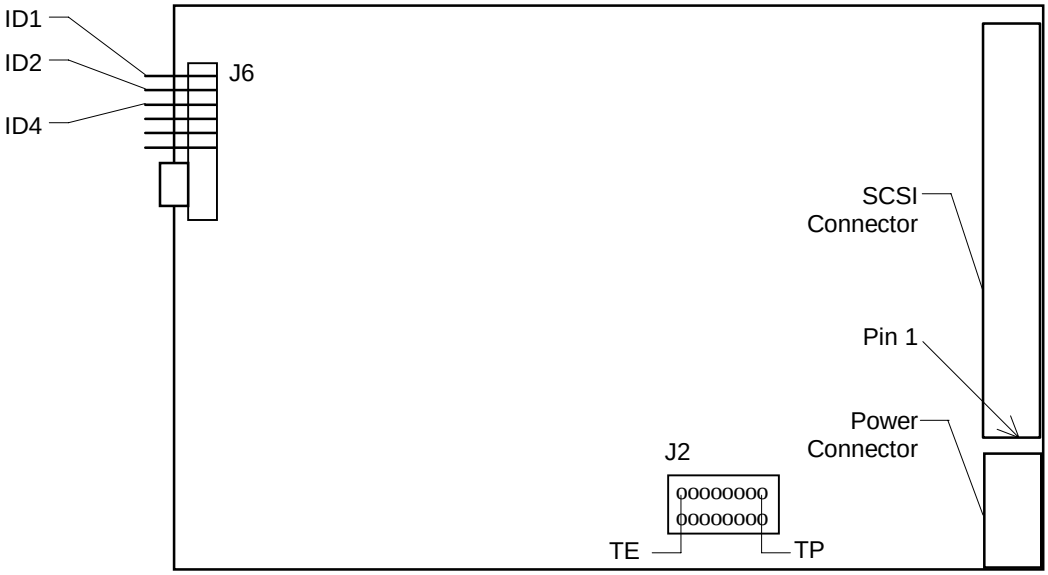
The following figure shows the jumper connector J8 on the back of the Seagate 1 GB disk drive.



- SCSI ID selection uses the ID1, ID2, and ID4 jumpers on connector J8. To enable SCSI termination, remove the Term Disable jumper and install both Term Power jumpers onto J8 To disable SCSI termination, install the Term Disable jumper and remove both Term Power jumpers from connector J8..

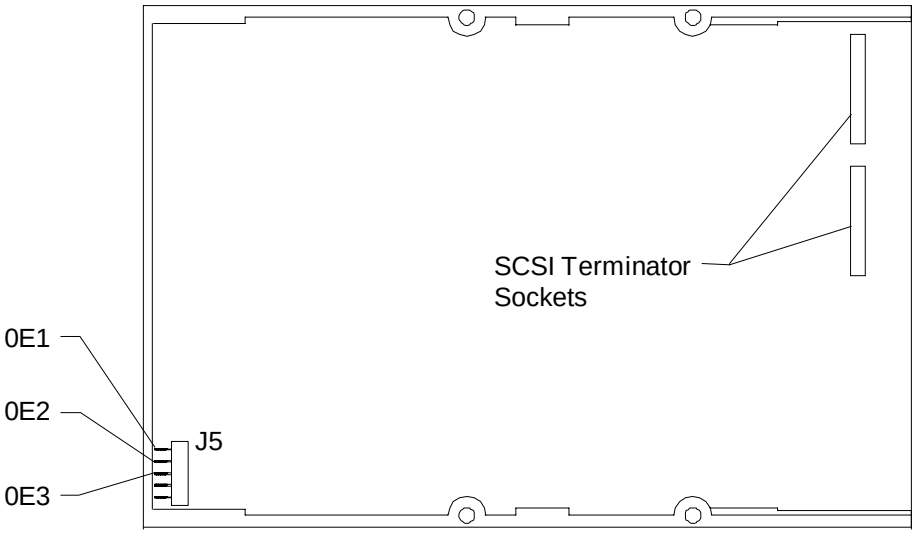
CDSK094 (2 GB)

The following figure shows the jumper connectors J6 and J2 on the Seagate 2 GB disk drive. SCSI ID selection uses the ID1, ID2, and ID4 jumpers on connector J6. To disable SCSI termination, remove the TE jumper from connector J2.



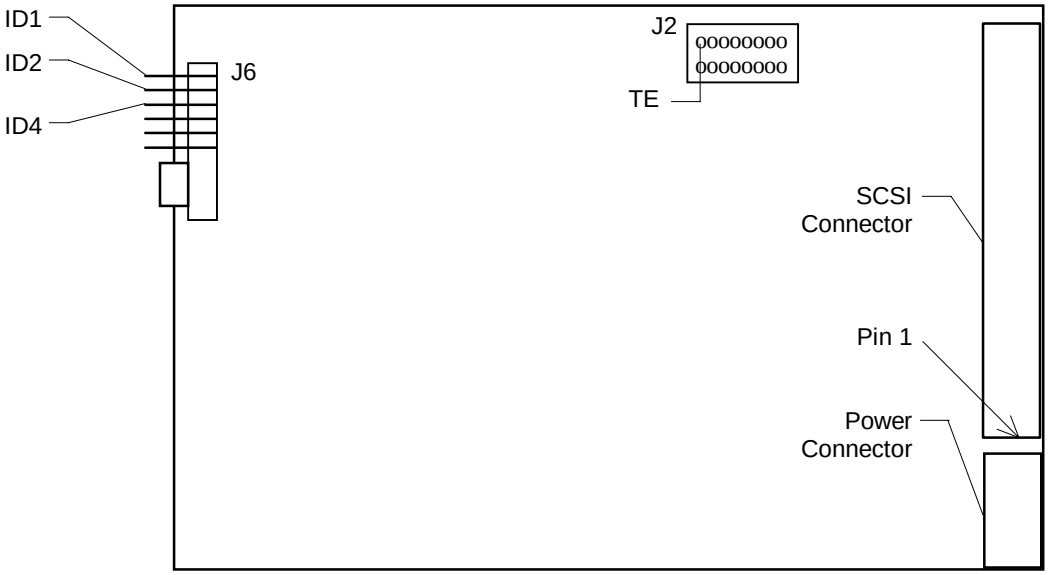
CDSK098 (4 GB)

The following figure shows the jumper connector J5 and SCSI terminator sockets on the Conner 4 GB disk drive. Connectors 0E1 through 0E3 are also available on a jumper block near the SCSI terminator sockets; do not install jumpers on these connectors. To enable SCSI termination, install the proper resistors into both terminator sockets. To disable SCSI termination, remove both resistors from the sockets.



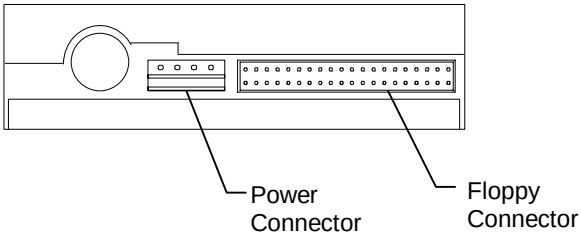
CDSK123, CDSK164, CDSK165, CDSK166, CDSK167 (4 GB)

The following figure shows the jumper connectors J6 and J2 on the Seagate 4 GB and 9 GB disk drives. SCSI ID selection uses the ID1, ID2, and ID4 jumpers on connector J6. To disable SCSI termination, remove the TE jumper from connector J2.



Floppy Disk Drive (CDSK146)

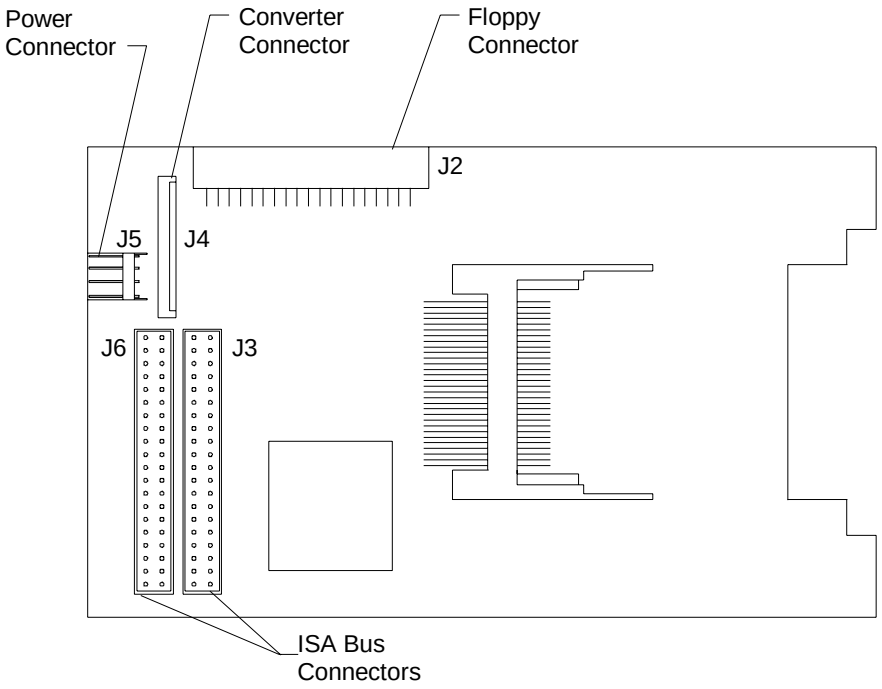
The following figure shows the cable connectors on the back of the floppy disk drive.



- The power connector uses power supply cable P9 from the power supply. Refer to Chapter 10, “Power Supply and Fans,” for the cable pinout.
- The floppy connector uses cable MCBLZ380 and connects to J30 on the system board. Refer to Chapter 5 or 6 for the cable pinout.

Combo Drive (MESAM86)

The following figure shows the cable connectors on the combo drive MESAM86.



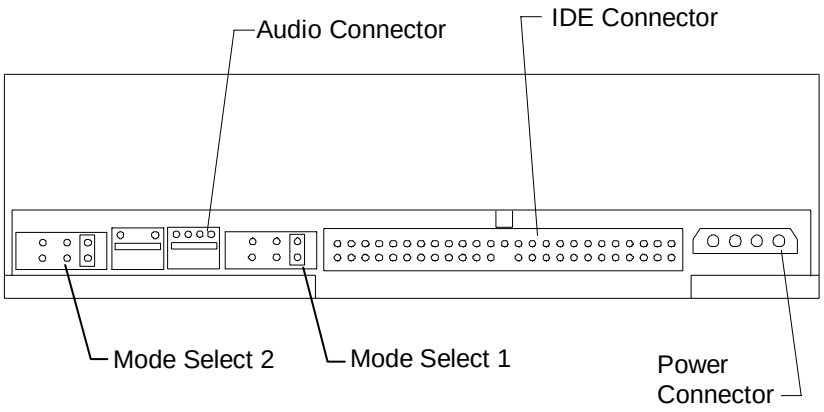
- The power connector uses power supply cable P9 from the power supply. Refer to Chapter 10, "Power Supply and Fans," for the cable pinout.
- The ISA bus connector J3 uses MCBL084A and connects to J33 on the MSMT353 system board. Refer to the table "J33, MCBL084A, PCMCIA ISA Bus" in Chapter 5 for the cable pinout.
- The ISA bus connector J6 uses MCBL084A and connects to J32 on the MSMT353 system board. Refer to the table "J32, MCBL084A, PCMCIA ISA Bus" in Chapter 5 for the cable pinout.
- The floppy connector uses cable MCBLZ380 and connects to J30 on the system board. Refer to Chapter 5 or 6 for the cable pinout. The floppy connector also uses cable MCBLZ230 to connect to the converter connector J4 on the combo drive.

  The following table shows the pinout of MCBLZ230.

Pin	Signal	Pin	Signal	Pin	Signal
1	VCC	10	MTR1-	19	Ground
2	INDEX-	11	No connect	20	TRK0-
3	VCC	12	DIR	21	Ground
4	DRV1-	13	No connect	22	WRPRT-
5	VCC	14	STEP-	23	Ground
6	DSKCHG	15	Ground	24	RDATA-
7	No connect	16	WDATA-	25	Ground
8	No connect	17	Ground	26	HDSEL
9	RPM	18	WGATE-		

EIDE CD-ROM Drive (CDSK177)

The following figure shows the back of the EIDE CD-ROM drive for the TDZ-425 RAX system. Install jumpers as shown.



- The power connector uses power supply cable P6 from the power supply. Refer to Chapter 10, "Power Supply and Fans," for the cable pinout.
- The audio connector uses MCBL122A and connects to J22 on the system board. Refer to Chapter 6 for the cable pinout.
- The IDE connector uses cable MCBL121A and connects to the Primary IDE Bus on the MSMT378 system board. Refer to Chapter 6 for the cable pinout.
- The Mode Select 1 header is jumpered "master" as shown. Settings for the mode select header are printed on the CD-ROM drive.

10 Power Supply and Fans

This chapter describes the 539-watt power supply and cooling fans used in all rack-mount systems. Differences among systems are noted.

Power Supply (MPWS145)

MPWS145 is a 539 watt autoranging supply, that switches between 90-132 VAC or 180-264 VAC, depending on the location. The input frequency is 47-63 Hz, single phase. At full load, the power supply has a minimum efficiency of 65 percent.

DC Output Specifications

The following table details the DC output specifications for the power supply.

	Output #1	Output #2	Output #3	Output #4	Output #5	Unit
Nominal Output Voltages [1, 5]	+3.3 [4]	+5.1 [4]	+12.0 [4]	–12.0	–5.0	VDC
Continuous Load (Maximum.) [1]	48 [3, 4]	76 [3, 4]	12 [4]	0.5	0.5	ADC
Continuous Load (Minimum.) [1]	0	6	0	0	0	ADC
Noise and Ripple (PARD) (DC to 30 MHz)	50	50	100	250	100	mVp-p Max
Initial Setting Tolerance [2, 5]	±3%	±3%	±5%	±10%	±10%	Max
Regulation Line/Load [2, 5]	±3%	±3%	±5%	±10%	±10%	Max
Overshoot (Turn on/off)	5%	5%	10%	10%	10%	Max

The following items apply to the table of DC output specifications.

1. The power supply meets or exceeds these specifications. For the noted specifications, the maximum values describe the smallest acceptable maximum load, and the minimum values describe the largest acceptable minimum load.
2. These outputs are measured at the user end of an unloaded peripheral cable.
3. +3.3 V and +5.1 V will never draw over 400 Watts combined.
4. Any combination of +3.3 V, +5.1 V, and +12 V do not exceed their maximum or 539 watts of total power.
5. The sum of Initial Setting Tolerance and Line/Load Regulation do not exceed 3% for the +3.3 V and +5.1 V outputs, 5% for the +12 V output, and 10% for the negative output voltages.

Cable Connectors

The following table shows the cable connectors from the power supply that connect to the riser card and to the devices in the system.

Connector	Device	SCSI ID
P1	Riser Card (Main Power)	
P2	System disk drive	0
P3	Add-on disk drive	1
P4	Add-on disk drive	2
P5	Add-on disk drive	3
P6	CD-ROM drive	4
P7	Tape drive/Other drive	5
P8	Not used	
P9	Floppy disk or combo drive	
P10	System key switch (MCBL166A)	

P1 Pinout

Pin	Signal	Wire Color	Pin	Signal	Wire Color
1	+3.3V	Orange	13	+5V	Red
2	+3.3V	Orange	14	Ground	Black
3	+3.3V	Orange	15	Ground	Black
4	Ground	Black	16	+5V	Red
5	Ground	Black	17	Ground	Black
6	Ground	Black	18	-12V	Blue
7	+3.3V	Orange	19	+5V	Red
8	+3.3V	Orange	20	-5V	Red
9	+5V	Red	21	Ground	Black
10	Ground	Black	22	+12V	Yellow
11	+5V	Red	23	Ground	Black
12	Ground	Black	24	Power Good	Green

P2 - P7 Pinout

Pin	Signal	Wire Color
1	+12V	Yellow
2	Return	Black
3	Return	Black
4	+5V	Red

P9 Pinout

Pin	Signal	Wire Color
1	+5V	Red
2	Return	Black
3	Return	Black
4	+12V	Yellow

P10 Pinout

Pin	Signal	Wire Color
1	System Reset	Yellow
2	No Connect	Black
3	Ground	Black
4	System On	Red

System Fans

Refer to Chapter 5 or 6 for fan cable pinouts and system board connector locations.

NOTE Airflow in the system is front to back. Arrows on the fan indicate airflow direction and rotation. Ensure fans are installed with airflow direction arrows pointing to the back of the system.

Power Supply Fan (MCBLZ52 or CFAN1170)

The power supply fan is a single, 119 mm fan (MCBLZ52), mounted on the rear left of the power supply housing. The power cable connects to MCBLZ530, which connects to J68 on the MSMT353 or MSMT359 system board.

On systems with the MSMT378 system board only, the power supply fan is a single, temperature-controlled, 119 mm fan (CFAN1170), mounted on the rear left of the power supply housing. The three-conductor power cable connects to the extension cable MCBL177, which connects to J68 on the MSMT378 system board.

System Fans (MCBLY690)

The system fans are two 80 mm (MCBLY690) fans, attached to the right rear of the power supply housing. The fan power cables connect to MCBL530, which connects to J68 on the MSMT353 or MSMT359 system board. On systems with the MSMT378 system board, the fan power cables connect to the extension cable MCBL177, which connects to J68 on the MSMT378 system board.

Vertical Bay Disk Drive Fan (MCBLY690)

The disk drive fan is MCBLY690, an 80 mm fan mounted to the vertical drive bay. The fan power cable connects to MCBLZ660, which connects to J69 on the MSMT353 or MSMT359 system board or connects to MCBL284A and to J64 on the MSMT378 system board.

Internal Bay Disk Drive Fan (MCBLY690)

The disk drive fan is MCBLY690, an 80 mm fan mounted to the internal drive bay. A hole on the back of the chassis provides access to the fan screws and grille. The fan power cable connects to MCBLZ660, which connects to J12 on the MSMT353 or MSMT359 system board or connects to MCBL284A and to J12 on the MSMT378 system board.

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